UNIVERSITY OF PENNSYLVANIA

NATIONAL REGULATION OF AERONAUTICS

BY

CHARLES C. ROHLFING

A THESIS

PRESENTED TO THE FACULTY OF THE GRADUATE SCHOOL IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

PHILADELPHIA
1931

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PREFACE

Five years have elapsed since the Department of Commerce undertook to regulate and promote civil aviation in the United States. The time for taking stock has arrived. How far has National regulation justified the hopes of its proponents? Has the aeronautical industry benefited by the Federal assumption of authority? Should the scope of National regulation and promotion of aviation be increased? Has the Federal Air Commerce Act adequately guaranteed to the public airworthy aircraft and competent pilotage? What about the administration of the Air Commerce Act? The success of future regulation demands that these questions be answered.

Sufficient time has elapsed to demonstrate some of the defects and some of the advantages of our regulative system. It is fortunate that Congress has enacted a law that permits flexibility of regulations. It is unfortunate that Congress did not appropriate the entire field of licensing aircraft and airmen to the Federal Government and thereby bar the States from such activities. But let us withhold our lamentations and rejoice in the fact that the forty-eight states have pursued only five different policies in regulating intrastate aviation.

Most of this study deals with the administration of the Air Commerce Act. One chapter has been reserved for the legal problems of aviation. The increasing use of the air as a medium of transportation has opened an entirely new field of speculative thought and legal development. What will be the final legislative and judicial attitude toward trespass by aircraft in the airspace over

your property? Will flying at low altitudes, acrobatics, hovering, or excessive noise constitute actionable nuisances? Suppose an aircraft crashes through the roof of your home, will the burden of proof be on you to show negligent piloting? The entire law of aviation is in its swaddling clothes. Our progressive lawyers will investigate its possibilities.

Most studies of administration contain a final chapter entitled "Conclusions and Recommendations." The author has succumbed to this universal temptation, but he has seriously attempted to refrain from ripping if he did not believe he could suggest repairs. That defects are apparent is no reflection on the efficiency of the personnel of the Aeronautics Branch, but, in many instances, on the shortsighted policy of Congress in refusing to grant adequate appropriations.

The author acknowledges with grateful appreciation the invaluable assistance of Dr. James T. Young of the University of Pennsylvania in the preparation of this book. Cordial thanks are extended to Dr. Charles E. Merriam of the University of Chicago for his aid in the arrangement of subject matter. The entire personnel of the Aeronautics Branch of the Department of Commerce have been most gracious in offering the author their whole-hearted coöperation. Particularly does the author wish to thank Messrs. S. W. Crosthwaite, E. P. Howard, K. M. Lane, R. S. Paulette, E. M. Kintz, and Dr. L. H. Bauer.

Philadelphia, Pa.
March 7, 1931.

CHARLES C. ROHLFING.

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I

INTRODUCTION

The popular impression that aviation is to become another of our major industries seems to be fully borne out by its rapid and phenomenal growth. The story of this growth commands interest even when told through the medium of statistics. Spectacular flights, endurance records, and the rapid development of scheduled transport lines have caused aviation to be constantly in the public eye. This consciousness of the possibilities of aviation has greatly advanced the industry. Air commerce is no longer a dream. It has become an integral part of the Nation's business. It has become an indispensable adjunct to commerce and industry. It has shrunk the map of the world to a third of its former size and has added whole days to the business week.

Because of the increasing importance of this industry, it is the object of this present work to consider what the Federal Government has done and what it should do to:

1. Insure by regulation that aircraft will be operated with a reasonable regard to the known elements of safety.
2. Provide for physical aids to air navigation.
3. Promote the development of the industry and the establishment of airports.
4. Engage in aeronautical research to advance the art.
5. Assure the free use of the navigable airspace.
6. Create a machinery capable of efficient regulation and speedy, inexpensive administration.

In order to present these problems with clarity it has been necessary to deal with certain legal and historical phases of regulation. One of these is the relation of the common law to Federal and State legislation affecting airspace ownership and liability of the aeronaut to persons and property on the ground. To serve as a historical background, two chapters have been introduced to indicate, first, the extent of Federal assistance previous to 1926 with its attendant attempts at legislation, and second, a discussion of the basic provisions of the Air Commerce Act of 1926 and its rather rapid administrative development. The fundamental problem of safety, the prime motive in all regulation, has been separately treated. Lastly, since the Air Commerce Act of 1926 is not all-inclusive in its jurisdictional scope, it has been necessary to examine existing state legislation to set forth its assistance to or interference with the aims of Federal regulation.

The Aeronautic Industry

Despite the popularity that aviation has enjoyed there are few people who could describe accurately the present-day scope of the aeronautical activities in the United States. For purposes of orientation it would seem advisable to set forth briefly some of the more pertinent statistics of the industry, the subject of regulation.

The Department of Commerce Statistics for February 28, 1929, February 15, 1930 and February 16, 1931, show the following mileages for scheduled air transport:[1]

[1] *Air Commerce Bulletin*, Department of Commerce, Vol. I, No. 16, p. 24; Vol. II, No. 16, p. 435.

	1929	1930	1931
Miles of mail airways operating	17,470	26,657	41,501
Miles of all airways operating	20,788	36,982	48,742
(Mail) airplane miles scheduled daily	38,045	51,844	77,526
(Non-mail) airplane miles scheduled daily	15,300	37,705	41,013
Airplane miles scheduled daily (Total mail and non-mail)	53,345	89,549	118,539

The total daily mileage, equal to a distance greater than four and one-half times around the world, is flown over 102 domestic and 18 foreign routes.

The status of licensed pilots and mechanics, licensed and identified aircraft on February 28, 1929, February 15, 1930 and February 16, 1931, indicates an active growth:

	1929	1930	1931
Pilot licenses active	6,608	10,701	15,289
Mechanic licenses active	5,285	7,931	9,052
Airplane licenses active	4,191	6,733	7,309
Airplane identifications	2,411	3,203	2,576

The airport statement of the Department of Commerce for February 16, 1931, classifies a total of 1,796 fields.

Municipal airports	555
Commercial airports	567
Department of Commerce intermediate fields	356
Army airdromes	54
Naval air stations	14
Marked auxiliary fields	246
Fields for miscellaneous govermental activities	4
	1,796
Proposed airports	720

A comparison of some statistics on the aircraft manufacturing companies will illustrate the growth of this phase of the aviation business in the United States:[2]

[2] *The Aircraft Year Book for* 1930, Aeronautical Chamber of Commerce.

	1928	1929
Value of planes, engines, and spare parts produced	$62,000,000	$98,000,000
Number of aircraft produced by 96 major manufacturers	4,219	6,034
Number of engines produced by 25 major manufacturers	3,711	7,378

The outstanding development of 1929 in the aviation industry was its phenomenal change in financial structure. Mergers and consolidations took the aeronautic world by storm. In December of 1928 United Aircraft and Transport Corporation was formed. The second group of the so-called "Big Four" in aeronautics, the Aviation Corporation, was announced in March of 1929, and the third group, the Detroit Aircraft Corporation, was formed in June of 1929. During all this period the Curtiss-Keys group and the Wright-Hoyt group had been acquiring control of a number of aviation enterprises, and in July of 1929 the two combined to form the Curtiss-Wright Corporation, the last company of the "Big Four." Many smaller groups in the industry immediately followed the example set by the four large consolidations noted above.[3] This urge to merge is but another illustration of the virility of the industry. What comparable industries such as steel, motors, and electric power have taken decades to achieve, aviation has sped through in but a couple of years.

The Department of Commerce has been confronted with the problem of adequately regulating this dynamic industry and at the same time permitting it to enjoy the greatest possible freedom in development. The Department occupies a difficult middle ground. A typical example of this difficulty is the frequent criticism, by

[3] For able discussions of this consolidation movement see R. Sydney Bowen, "The Aeronautic Industry During 1929," *Aviation*, February 15, 1930, p. 306; Talbot O. Freeman, "What Price Merger," *Aviation*, December 7, 1929, p. 1105.

the industry, that minimum requirements for airworthiness of aircraft are of such a nature as to restrict definitely the inventive genius of aeronautical engineers. In a recent address, Mr. K. M. Lane, Chief of the Engineering Section, made this statement: "Structural failure is being virtually eliminated from consideration in approved airplanes." The processes of analysis are being so improved, and are sufficiently well understood, as to make certain that a plane will hold together under any flight conditions that can be reasonably expected. "No matter what other virtues a plane may possess, it is difficult to appreciate them properly if the wings start falling off."[4] In support of the rigorous enforcement of the much discussed spinning regulations, he observes that "human curiosity knows no limit, therefore there is no limit to what airplanes must be prepared to stand."[5]

Because the year 1926 marked both the beginning of the boom period of aviation and the assumption of regulatory jurisdiction by the Federal Government, the administration of the Air Commerce Act has been particularly difficult. The Department of Commerce has been constantly faced with the dual problem of initiating regulatory provisions of an unprecedented nature and at the same time keeping abreast with an industry growing at an average rate of 60 per cent per year. The educational program necessary to apprise the industry of the regulatory requirements was, in itself, a heavy task. The Department of Commerce has exercised excellent judgment in proceeding most cautiously in the extension of its regulatory jurisdiction. Building on the firm foundation of experience and frequent consultations with the industry

[4] Address before the Aeronautical Banquet of the Society of Automotive Engineers at St. Louis, Mo., February 26, 1930.

[5] *Ibid.*

the Department is setting a precedent that might well be followed by other Federal regulative agencies.

It will be the purpose of this work to study the methods employed, the problems met, and the success attained by the Department of Commerce in its attempt to regulate, encourage, and foster the aviation industry, and to present some conclusions as to future regulation.

II

FEDERAL ASSISTANCE TO AVIATION AND ATTEMPTS AT REGULATION PREVIOUS TO 1926

To present a complete picture of the present activities of the Federal Government in the regulation and encouragement of aviation, it would seem advisable to discuss the extent to which governmental interest manifested itself in this activity previous to the passage of the Air Commerce Act of 1926. It would also seem expedient to consider the general character of the legislation introduced in Congress in order that these bills might be comparatively studied in reference to the provisions of the Air Commerce Act of 1926.

The National Advisory Committee for Aeronautics

The creation of the National Advisory Committee was probably the most important assistance offered by the Federal Government to commercial aviation previous to 1926. This Committee was created by act of Congress approved on March 3, 1915. The organic act charges the Committee with the supervision and the direction of the scientific study of the problems of flight with a view to their practical solution; the determination of problems which should be experimentally attacked, and their investigation and application to practical questions of aeronautics.[1]

[1]Act of Congress, 38 Stat. 903.

The Committee has described its functions as follows:

1. Under the law the Committee holds itself at the service of any department or agency of the Government interested in aeronautics.

2. The Committee may exercise its functions for any individual, firm, or corporation, providing that individual, firm, or corporation defray the actual cost involved.

3. The Committee institutes research which is considered needful or timely for the advance of aeronautics.

4. The Committee holds itself at the service of the President, the Congress and the executive departments of the Government for the consideration of special problems which may be referred to it.[2]

In an act approved July 2, 1926, an addition function was assigned to the Committee.

There was created an Aeronautical Patents and Design board, consisting of the Secretaries of War, Navy, and Commerce. Section 10 (r) of that act[3] provided that "upon the recommendations of the National Advisory Committee for Aeronautics the Patents and Design board shall determine questions as to the use and value to the government of aeronautical inventions submitted to any branch of the government."

The primary function of the National Advisory Committee for Aeronautics is the supervision and completion of aeronautical research of a scientific nature. It is needless to say that the scientific solutions of such problems as the corrosion of magnesium, aerodynamic characteristics of airfoils, etc., have been of great value

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[2] National Advisory Committee for Aeronautics, Twelfth Annual Report, p. 2.

[3] Public, No. 446, 69th Congress.

to the aeronautical industry.[4] It is, however, to be especially noted in any appraisal of the work of the National Advisory Committee, that it has been a potent factor in providing a never-wavering enthusiasm for Federal regulation of commercial aviation. An examination of the annual reports of the National Advisory Committee from 1919 to 1926 will show an annual recommendation for Federal regulation.[5]

Other Research Agencies

Much of the research work of the National Advisory Committee for Aeronautics has been completed under the supervision of the Bureau of Standards of the Department of Commerce. This bureau has acted as a field station for various governmental agencies engaged in aeronautical work. An excerpt from the testimony of Dr. George K. Burgess, Director of the Bureau of Standards, before the President's Aircraft Board will illustrate this relationship: "In the aviation work of the Bureau of Standards, a Government department may be interested in some field of activity, either scientific, technological or engineering, in which we can help them. In this present year[6] the National Advisory Committee for Aeronautics transferred $32,600 for work on aeronautic instruments, wind tunnel problems, power plants, substitute for parachute silks, duralinium fatigue, and embrittlement of duralinium. The Navy Department transferred $54,000 to the bureau for work on aircraft structures, aircraft instruments, photographic emulsions, duralinium corrosion, etc. . . . If it is in order I would

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[4] For summary of the technical work of the N. A. C. A. see Annual Reports of N. A. C. A.

[5] *Ibid.*, Fifth to Twelfth Annual Report.

[6] 1925.

like to point out that the army aviation has referred to the Bureau of Standards quite frequently problems of a technical nature."[7]

Other facilities for aeronautic investigation and research that might be mentioned are those under the direct supervision of the Navy Department and the War Department. As early as 1915 the Navy Department was equipped with a model basin and wind tunnel at the Washington Navy Yard, and theoretical and practical design was being worked out in the Bureaus of Construction and Repair and Steam Engineering. The Naval Air Factory at League Island, Philadelphia, was a later development. The War Department in 1915 was engaged in aeronautical research at the flying school at San Diego.[8] Research and experimental work by the Army and Navy have been of tremendous value to present-day commercial aviation.[9]

At present the Aeronautic Branches of the War and Navy Departments are engaged in extensive researches in nearly every phase of aeronautic work.[10]

In the Department of Agriculture are two divisions that have aided aeronautical development. The Forests Products Laboratory conducts practically all the investigations of interest to aviation in respect to the use of woods and glue in aircraft construction. The Weather Bureau has constantly made available weather reports to aviation interests. Previous to 1926 they had established

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[7] Aircraft: Hearings before the President's Board, I, 340.

[8] For short summary of early research facilities of the Federal Government see First Annual Report of N. A. C. A., p. 18.

[9] For summary of aviation activities of military forces, see Annual Reports of the Secretaries of War and Navy.

[10] Illustrating the intensiveness of this work, see *Simple Aero-Dynamics and the Airplane*, prepared by Chas. N. Monteith under the direction of the Chief of the Air Corps, U. S. Army.

upper-air meteorological stations and radio systems of weather reporting.[11]

Air Mail Development

The discussion, so far, has dealt with aids of a technical nature afforded to the aeronautical industry by the Federal Government. To the Post Office Department falls most of the credit for the establishment of scheduled air transport. On May 15, 1918, the first air mail route was established between Washington and New York. This service was first operated by the War Department, but the entire operation was taken over by the Post Office Department on August 12, 1918. This route was continuously operated until May 31, 1921, when it was discontinued. Because of the shortness of this route it was not of great value as a time saver. The Post Office Department was anxious to establish a transcontinental route to test the economic practicability of mail transportation by air. On May 15, 1919, the first leg of such a transcontinental route was put into operation between Cleveland and Chicago. On July 1, the operations were extended from New York to Chicago. The third leg from Chicago to Omaha City was established on May 15, 1920, and the last leg, Omaha City to San Francisco, on September 8, 1920. Other experimental routes were established and discontinued, notably the Chicago-St. Louis and the Minneapolis-St. Paul routes.

It soon became apparent that night operation was necessary to insure the success of mail transportation by airplane. This necessitated the establishment of lighted airways, illuminated landing fields, and additional equip-

[11] For early history of Weather Bureau see magazine *Air Power*, April, 1920, p. 115.

ment on the planes themselves. The first lighted airway operated by the Post Office Department was opened on July 1, 1924. This lighted route was established between New York and Rock Springs, Wyoming. Its length was 1,886 miles. The cost was reported by the Post Office Department as $514,405.48.[12] On September 23, 1925, Harry S. New, Postmaster-General, made the following statement: "Up to this time the Post Office Department on all its air mail operations has spent about $10,000,000. It may have spent a little more, because during the early years most of the air mail expense was paid out of star route and railway mail appropriations, but the amount diverted could not have been very large, as the operations themselves were not very extensive."[13]

The greatest contribution which the Post Office Department made was the encouragement it gave to potential commercial operators. The systematic growth and efficiency of the air mail service proved that scheduled air transport was economically possible. In 1925 the Post Office Department was operating 2,700 miles of air mail routes, and the total mileage flown during that year had reached 2,070,000 miles.[14] Commercial operators realized that with the addition of express and passenger business, which the Post Office Department was not handling, plus the energetic recruiting of business which would follow with private operation, such private operation might prove profitable or at least could be operated without loss. Post Office expenditures in lighting airways also indicated that this service would most probably be provided for in the future by Federal appropriations. An airway is by its very nature a public

[12] Aircraft: Hearings before the President's Board, I, 266.

[13] *Ibid.*, I, 267.

[14] Aircraft: Hearings before the President's Board. Statement by Herbert Hoover, I, 320.

right of way. Private operators could hardly be expected to provide their own lighting facilities if such facilities could be used by every one of their competitors. The only just compensation to a private company for private erection and maintenance of an airway would be the granting of a monopoly on that airway. Such a procedure would hardly be in keeping with the unshackled economic development of aviation transport.

In the opinion of Harry S. New, government operation of the air mail was the primary factor in attracting capital to the aviation transport business. He states, "The service has attracted attention and that it justifies itself by results will, I think, be conceded." He continues, that the value is "best set forth by the result of the department's recent bids for private conduct of air mail routes. Sixty days or more ago we advertised for the establishment of eight new contract air mail services. We received 19 bids, coming from 12 different companies and individuals." These bids "have been made in good faith and represent a real purpose on the part of the bidder to undertake the service."[15]

The most important aviation act passed by Congress just previous to 1926 was the Kelly Act or the Contract Air Mail Act.[16] This statute of February 2, 1925, authorized the Postmaster-General "to contract with any individual, firm or corporation for the transportation of air mail by aircraft between such points as he may designate at a rate not to exceed four-fifths of the revenues derived from such air mail."[17] The Air Mail Act was

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[15] Aircraft: Hearings before the President's Board. Statement by Herbert Hoover, I, 267.

[16] 43 Stat. 805.

[17] *Ibid.*, Section 4.

further amended on June 3, 1926[18] and on May 17, 1928.[19]

In accordance with the provisions of the Kelly Act the Postmaster-General issued advertisements on July 15, 1925, calling for bids for eight contract air mail routes. On September 21, 1926, advertisements were issued calling for bids on four more routes.

By April, 1926, the Post Office Department had completed eight years of continuous air mail service. To the close of the calendar year 1925, the mileage flown closely approached 12,000,000 miles. Air mail operation was well advertised. It had become very popular with the banking interests for quick check and draft collections. Post Office records indicated 95 per cent completion of scheduled trips.[20] This was the picture that the Post Office Department presented to potential contract operators of air mail routes. Without this pioneering effort of the Post Office Department proving the practicability of scheduled air transport, it is doubtful whether the advertised contract air mail bids of 1925 would have received very much attention from responsible air transport companies. It is of interest to note that by the end of the calender year 1926, fourteen contract air mail routes were in operation.[21] In view of the fact that most corporations enter business to make money, great credit must be given to Post Office operation in selling the money-making potentialities of transport aviation.

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[18] 44 Stat. 692.

[19] 39 Masons U. S. C. 463, 465-1.

[20] Statistics by Hon. W. Irving Glover, Second Assistant Postmaster-General, *Aviation,* April 5, 1926, p. 488.

[21] Department of Commerce, Aeronautics Bulletin No. 1, p. 6.

Miscellaneous Use of Aircraft

Previous to 1926, certain miscellaneous uses of aircraft by Federal agencies might be noted. On June 1, 1919, the first air patrol for forest fire protection was begun in California. Seven patrols were covered. During 1919 a total of 2,457 hours were flown, totaling a mileage of 202,009. The entire cost of these operations was borne by the War Department. The patrols were abandoned in October 1919 due to lack of funds. In 1920, $50,000 was appropriated. Most of this was spent in the summer of 1920. From 1920 to 1924 sporadic patrols were flown with the coöperation of the War Department. In 1925, Congress appropriated $50,000 to be used for forest patrol in 1926. This forest patrol work would not have been possible without the assistance of the War Department.[22] Some use of aircraft by the U. S. Coast Guard was reported by Secretary of the Treasury, Andrew W. Mellon. The utilization of aircraft by the Coast Guard has not been extensive, but it has demonstrated its great possibilities in Coast Guard work. Secretary Mellon reported the airplane of great value to the Coast Guard "for the detection of vessels engaged in smuggling for reconnoissance over the anti-smuggling forces of the Coast Guard, for inspection purposes, for the location of derelicts and floating menaces to navigation and for locating vessels in distress."[23]

As early as 1919 the Department of Agriculture used aircraft in entomological work in the effort to locate outlaw cotton fields which had escaped discovery in connection with the inspection and control work against the

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[22] For further details see statement of W. B. Greeley, Forester, U. S. President's Aircraft Board, I, 352.

[23] Statement by Andrew W. Mellon, U. S. President's Aircraft Board, I, 351.

pink bollworm in Texas. During 1922 and 1923, flights were made for the distribution of poison dust on forest areas in New Hampshire affected by gypsy-moth caterpillars. In 1923, an airplane was borrowed from the War Department to carry on experiments in the dusting of calcium arsenate on the cotton fields of Louisiana and Mississippi. Aircraft have also been used for the dusting of peach trees against the plum curculio. Approximately 100,000 trees were dusted at Montezuma, Georgia, in 1925. Dr. L. O. Howard, Entomologist for the Department of Agriculture states, "the use of aircraft in large scale coöperative work in agriculture in the distribution of insecticides seems to have a promising future."[24]

These miscellaneous usages of aircraft are perhaps not important in themselves, but they have served as valuable advertisements of the versatile possibilities of aircraft use.

Legislative Attempts at Regulation Previous to 1926

Serious attempts to secure Federal legislation for our air commerce began approximately in 1920. Two factors may be said to have retarded the passage of such legislation. First, the method to be employed in regulating air commerce, and secondly, the question of constitutionality of such legislation. The former resulted itself primarily into a dispute as to the grouping of aviation activities in respect to control.

The Controversy as to Control

The disputants maintained two principal points of view. One side believed that all aviation activities in

[24] U. S. President's Aircraft Board, I, p. 356.

the United States (including military as well as commercial) should be placed under the control of an executive department in the cabinet especially created for such a purpose.[25] Such a plan, it was maintained, would bring about absolute coöperation between the various aviation activities in the United States. The other side, composed mostly of military officers, believed that the status quo should be maintained. Control over military aviation should be continued under the War and Navy Departments respectively, and commercial aviation should be developed separately. The following quotation from the statement of Dwight F. Davis will illustrate the point: "There is a tendency on the part of some to advocate that the development of civil aviation be dependent upon the organization and development of military aviation. This, the War Department believes, is wrong in principle and contrary to our national customs and experience. In accordance with our accepted theory and practice of national defense, civil aviation must never be subordinate to or controlled by military aviation, as it might be were they both in the same executive department. Furthermore, as aviation is developing so rapidly and the cost of maintaining adequate air fleets for war purposes is prohibitive, no nation contemplates maintaining in its military forces the aviation to be used in an emergency. The necessary reserves of both personnel and material must be made available through the development of civil aviation."

"The development of civil aviation depends upon

a. Legislation for the regulation of civil air navigation.

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[25] For an excellent exposition of this, see Statement of Harry S. New before the U. S. President's Aircraft Board, III, 1187.

b. Federal encouragement and assistance to commercial aviation.

c. A healthy aircraft industry.

d. The continuation and progress of scientific research and experimental work in aeronautics and aircraft design." [26]

Constitutionality

The second factor blocking legislative attempts at regulation was the question of constitutionality. It might be stated before entering into such a discussion, that the ideal situation would most probably be an amendment to the Federal Constitution expressly conferring upon Congress the exclusive power of jurisdiction over international, interstate, and intrastate aerial navigation. While such an amendment was proposed, it was not seriously considered because of the difficulty of securing the passage of amendments to the Federal Constitution.

There is, of course, no direct mention of air navigation of any kind in the Constitution. Disregarding the possibility of a constitutional amendment, the power of Congress to regulate air navigation must be found within the Constitution. Four such constitutional bases have been proposed.[27]

It has been suggested that Congress has the power to regulate aviation under the war powers on the theory that the aeroplane was an instrument of war. Such a constitutional basis seems hardly reasonable. There are too many commercial instrumentalities that become instruments of war during hostilities, such as trucks, railroads, steel factories, etc.

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[26] U. S. President's Aircraft Board, I, 51.

[27] *Aviation Report.* The Joint Committee on Civil Aviation of the Department of Commerce and the American Engineering Council, p. 118. *Aircraft Law,* George B. Logan, p. 33.

It was thought that Congress could regulate on the constitutional basis of the Admiralty clause. "The judicial power (of the United States) shall extend to . . . all cases of admiralty and maritime jurisdiction."[28] Such jurisdiction has always been limited to water navigation and the possibility of extending it to air navigation was a remote one. The federal courts had already refused to apply the law of marine salvage to aircraft on water.[29]

A third possible basis was the treaty-making power. If the United States should enter into a treaty with other powers regulating the aeroplanes of each power, then Congress could pass a law which would carry into effect that treaty. Such legislation would invalidate any existing state legislation which conflicted with the federal statute.[30]

A fourth possibility was the commerce clause of the Constitution.[31] This constitutional basis was the one finally used in the Air Commerce Act of 1926. This clause grants to Congress the power to "regulate commerce with foreign nations, and among the several states, and with the Indian tribes."

W. Jefferson Davis states, "It may safely be said, therefore, that it has come to be recognized by leading constitutional authorities throughout the country that the uniform regulation of aeronautics is not only desirable but absolutely indispensable to the development of aerial transportation as an instrumentality of interstate commerce, and entirely within the constitutional functions of Congress."[32]

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[28] Article III, Section 2, clause 1.

[29] The Crawford Bros. No. 2, 215 Fed. 269. In re Reinhardt, 232 N. Y. 115.

[30] U. S. v. Chauver, 221 Fed. 228, U. S. v. Selkirk, 258 Fed. 775.

[31] Article I, Section 8, clause 3.

[32] *American Bar Association Journal,* July, 1923, p. 421.

The General Recognition of the Necessity of Regulation

Since 1920 federal regulation of commercial aviation has been urged almost universally by various governmental agencies and aeronautical associations. In 1921, the necessity for such legislation was urged by President Harding in his first message to Congress. In 1923, President Coolidge especially urged such legislation. The National Advisory Committee for Aeronautics has annually recommended Federal legislation from 1919 to 1926. Among the private associations, the National Aeronautic Association has vigorously sought enactment of federal legislation since 1922. In a statement on March 9, 1925, the association concludes its argument as follows:

"We end, as we begin, with the devout hope that the incoming Congress will find time to reach a vote on some Federal measure along the general lines of the Winslow bill, confident in the belief that in this event that Congress will give us the needful governmental guarantee of safety in flight and establish rules of the road, without which the aircraft industry cannot be developed along the safest lines."[33]

The Aeronautical Chamber of Commerce is another of the non-governmental agencies that has constantly recommended Federal regulation. On March 6, 1922, this organization issued a statement asserting that: "The success of air transport is bound up with, and vitally depends, on the promulgation of an efficient air code. . . That the directors advocate the creation of a bureau within the Department of Commerce for the development

[33] The President's Aircraft Board, I, 52.

and regulation of commercial air transportation in interstate and foreign commerce."[34]

Proposed Legislation

The number of bills introduced in Congress in the period from 1920 to 1926 to provide air commerce regulation is remarkable in consideration of the fact that none of them were passed by both houses of Congress. The National Advisory Committee for Aeronautics submitted a draft of proposed regulations to the President on February 21, 1919. This draft was approved by the President on February 25, and submitted to Congress. It failed to get out of the committee. The reason given for its failure to get before Congress was the rush of business then being handled by Congress.[35]

The Kahn Bill and the Hicks Bill

Representative Kahn introduced a bill in the 66th Congress that was approved by the National Advisory Committee on Aeronautics. This bill was introduced in the House of Representatives on May 13, 1920.[36] It provided for the establishment of a bureau in the Department of Commerce, in charge of a Commissioner of Air Navigation whose duties would comprise the licensing of aircraft and pilots, the designation of flying routes, coöperation with the states and the municipalities in the laying out of airdromes, and, in general, the promotion of all matters looking to the advancement of commercial aviation. The Commissioner of Air Naviga-

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[34] *Aviation,* March 6, 1922, p. 286. February 27, 1922, p. 260.

[35] National Advisory Committee for Aeronautics, Fifth Annual Report.

[36] H. R. 14601—66th Congress.

tion was to be made a member of the National Advisory Committee and was directed to seek the approval of the Committee on certain matters such as the laying out of flying fields.

A second bill introduced by Representative Hicks also received the approval of the National Advisory Committee.[37] Practically the same provisions for regulation and development were provided in this bill as in the Kahn Bill described above. Several additions might be noted. The bill provided for coöperation between the various departments of the government in the preparation of programs for research and experimental work in aeronautics, and also in the purchase of aircraft, engines, accessories and hangars, and acquisition of land for purposes in connection with aviation. Such coöperative plans were to be submitted to the National Advisory Committee for their consideration and recommendations.

The National Advisory Committee for Aeronautics comments on these two bills as follows: "The Hicks Bill as modified is responsive to that sentiment in Congress which has sought to prevent duplication of expenditures and effort in the military and naval air forces. The Committee is not wholly convinced that the necessity for such legislation exists at the present time nor that the method proposed would have the desired result. On the other hand, the Committee is unanimous in supporting the Kahn Bill as modified. The most urgent need at this time is the development of commercial aviation under Federal regulation. There has been some objection to the placing of air navigation under the Department of Commerce, but the National Advisory Committee for Aeronautics believes it unnecessary and unwise to create another independent Government establishment for the

[37] H. R. 14137—66th Congress.

exercise of such functions, and that by making the Commissioner of Air Navigation a member of the National Advisory Committee for Aeronautics, and requiring him to submit his plans to the Committee, he cannot fail to be guided in his actions by considerations of paramount national interests."[38]

Representative Curry introduced a bill in the 66th Congress which contained a different principle of administration.[39] It provided for the creation of a Department of Air with jurisdiction over all civil and military aeronautics. The final draft of this bill was introduced in the 68th Congress.[40] It provided for a Department of Air under the direction of the War Department. This department was to have four divisions—the Air Forces, the Division of Civil Aeronautics, the Division of Supplies, and the Division of Research. At the head of each was to be an officer appointed by the President and the Senate. This department was to assume all aeronautical activities of the Government including those of the War, Navy, Post Office, and Treasury Departments. The work of the National Advisory Committee for Aeronautics was to be taken over by the new department and the National Advisory Committee was to be abolished. Regulations for civil aircraft were to be promulgated by the Secretary of War, and a new jurisdiction known as Air Admiralty was to be vested in the Federal courts. Provisions for licensing pilots and craft were very similar to the Kahn Bill.

A second bill was introduced by Representative Kahn in the 67th Congress similar in general form to

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[38] National Advisory Committee for Aeronautics. Six Annual Report, p. 11.

[39] H. R. 7925—66th Congress.

[40] H. R. 12285—68th Congress.

the bill he had introduced in the 66th Congress.[41] In the latter bill provision was made for an Air Navigation Commission composed of one representative each from the Post Office, War, Agriculture, Treasury, State, and Commerce Departments, and one representative from the National Advisory Committee for Aeronautics. All the members of this air navigation commission were to be appointed by the President. The commission was empowered to draw up regulations and rules of the air. Such regulations were to be approved by the Secretary of Commerce before becoming effective. It may be said at the outset that the divided system of control provided by this act would not be very conducive to efficient administration. Another feature of this bill which would have been very unfavorable to the unhampered development of the aviation transport business was the authority given to the Secretary of Commerce to fix maximum rates for services of aircraft. Legislative restrictions of this type should be reserved for a later date of aviation development. All aircraft, except those engaged in foreign commerce and licensed by a foreign state, would be required to obtain a license from the United States. The bill further required United States citizenship as a requisite for the granting of a Federal license. Pilots were required to take an annual examination based on their mental, physical, and technical qualifications, and to secure a Federal license. It also provided for the licensing of airdromes and required that airdromes be owned by United States citizens or corporations whose stockholders were composed of a majority of American citizens. All aircraft and air space of the United States were placed under the jurisdiction of the Federal Court on Admiralty; and all the Federal mari-

[41] H. R. 14601—66th Congress. H. R. 202—67th Congress.

time law then in existence was to be made applicable to air navigation.

Congressman Winslow had introduced several bills in Congress.[42] The final draft of his bill was reported to the House of Representatives as an amendment to the bill of Senator Wadsworth.[43] The American Bar Association had approved this bill and recommended its passage. It had also received the approval of many of the executive departments of the Government, including War, Navy, Post Office, Treasury, and Commerce.[44] This bill vested administrative authority in a Bureau of Civil Aeronautics in the Department of Commerce. It directed the Secretary of Commerce to encourage, foster, and promote civil air navigation, to make such rules as are necessary for civil air navigation, and to provide for the examination and licensing of pilots, and the inspection and registration of aircraft and air navigation facilities. The bill declared the sovereignty of the United States in the national air space. It defined the responsibility of various Federal officers in prescribing regulations for the report, entry, and clearance of civil or public aircraft of American or foreign registration. It provided for the liabilities of common carriers engaged in air transportation, and prescribed the application to air navigation of existing laws relating to customs, public health, narcotic drugs, neutrality and the Coast Guard. Another provision of the bill increased the membership of the National Advisory Committee for Aeronautics by three members; one from the Bureau of Civil Air Navigation, one representing the air mail service, and one from the Coast Guard. This bill was by far the most comprehensive

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[42] H. R. 10522—68th Congress.

[43] S. 76—68th Congress.

[44] U. S. President's Aircraft Board, I, 52.

one that had been[45] introduced in Congress up to 1925.[46]

The Merritt-Parker Bill and the Bingham Bill

It was not until the 69th Congress that legislative attempts resulted finally in a regulatory statute. The Air Commerce Act of 1926 was the result of a conference on the Merritt-Parker Bill of the House of Representatives[47] and the Bingham Bill of the Senate.[48]

In the Merritt-Parker Bill the Secretary of Commerce was designated as the administrative agent. An additional Assistant Secretary of Commerce was to be appointed to take direct charge. He was empowered to encourage the establishment of airports, to make recommendations to the Secretary of Agriculture as to necessary meteorological service in connection with the maintenance of airways, to study the possibilities of commercial air transportation in the United States, to advise with the Bureau of Standards in regard to the carrying forward of research work, to investigate, record, and make public the causes of aviation accidents, and to exchange with foreign governments information pertaining to civil air navigation.[49] In the second section of this bill, the Secretary of Commerce was given regulatory power to provide for the registration of eligible aircraft after an examination and rating as to airworthiness, to provide for the periodic examination of airmen based on

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[45] For legislative history of S. 76—68th Congress, consult Congressional Record for first session of 68th Congress, Senate Report No. 15. Also, pp. 705, 754.

[46] For further discussion of this bill see The Joint Committee on Civil Aviation of the Department of Commerce and the American Engineering Council *Civil Aviation,* p. 117.

[47] H. R. 4772—69th Congress.

[48] S. 41—69th Congress.

[49] H. R. 4772—69th Congress, Section 1.

character, physical fitness, training, and practical experience, to provide for the periodic examination of air navigation facilities, and to establish air traffic rules for the navigation and protection of aircraft in the navigable airspace or waters of the United States. The Secretary of the Treasury was empowered to designate places in the United States as ports of entry for aircraft, and detail to such ports of entry, officers of the customs service.

An interesting feature of this bill, that was not incorporated in the Air Commerce Act of 1926, was the provision that all aircraft were compelled to be registered as aircraft of the United States and have aircraft certificates before being permitted to operate in the navigable airspace of the United States.[50] Experimental aircraft and foreign aircraft of a nation which granted reciprocal privileges to the United States aircraft, were exempted from this provision.

The Bingham Bill passed the Senate on December 16, 1925. This bill restricted compulsory registration to aircraft engaged in interstate and foreign commerce, whether or not in the navigable airspace of the United States, and whether commercial or non-commercial. It provided for the inspection of each aircraft before it is used in interstate or foreign commerce and the certification of its condition, capacity, and safety at the date of the inspection. This primary inspection was to be followed by other periodic inspections as to continued airworthiness. The Senate bill authorized the Secretary of Commerce to examine and determine the qualifications of individuals to serve as airmen in connection with any aircraft in the United States. The bill contained no provision similar to the Merritt-Parker Bill for the rating

[50] H. R. 4772—69th Congress, Section 13.

of air navigation facilities. The Bingham Bill made provision for the formulation of air traffic rules, but failed to fully define the extent or scope of such rules.

Aids to navigation were to be established and operated by the Secretary of Commerce within the limits of the appropriations made by Congress. These aids were to consist of aerial lights, lighthouses, signal stations, radio directional finding facilities, and radio communication facilities, whether along air routes, air ports, emergency landing fields or elsewhere. The important variation in this provision from other bills was the extension of Federal aid to airports in respect to lighting facilities. The retention of this feature might have been a potent factor in the greater encouragement of airport development by the municipalities. This observation is based upon the comprehensive road-building plans promulgated and completed by the States since Federal aid has been granted for road construction; and, secondly, the obvious lightening of the financial burden borne by the municipalities in airport development, if the cost of lighting such airports was shifted to the Federal Government.

The Senate bill provided for an administration similar to the House bill. An Assistant Secretary of Commerce was to be appointed by the President with the consent of the Senate. The only point of difference was that the House bill definitely stated that the new office of Assistant Secretary was to be in addition to that now provided for by law, and that his functions were to be confined to civil air navigation.

The Bingham Bill,[51] as amended by the Merritt-

[51] For full legislative history of S. 41—69th Congress, consult Congressional Record of 69th Congress, pp. 474; (Senate Rept. 2), 763, 827, 842, 855, 915, 917, 920, 7317, debates; 926, amended and passed the Senate; 1169, referred to House Committee on Interstate and Foreign

Parker Bill, was the one that was finally passed and became the Air Commerce Act of 1926.

Trends Noted in Bills Introduced

Several tendencies may be noted in the types of bills introduced from 1920 to 1926.[52]

1. The recognition that commercial aviation must be developed separately from military aviation; Federal treatment of each type must be segregated.

2. The general acceptance of the Commerce Clause[53] of the United States Constitution as a basis for a regulatory statute as opposed to such other possible bases as the war powers, the admiralty clause, or the treaty-making power.

3. The general substitution of the single administrative head, usually an assistant secretary in the Commerce Department, for the collective groups in the form of a bureau, board, or commission provided for in the earlier acts.

Commerce; (House Rept. 572) 5818, reported with an amendment; 7312, 7330, amended; 7397, Senate disagrees to House amendment, asks conference; 7397, 7522, conferees appointed; 7522, House insists upon its amendments, agrees to conference; (House Rept. 1162) Conference report submitted to House; (Senate Document, 108) 9059-9062, conference report submitted to Senate; 9351-9362, debated and agreed to; 9581, 9587, examined and signed; 9586, presented to President; 9811, Approved (Public, No. 254).

[52] In this chapter I have described only those bills which received the most serious consideration. For a perusal of other bills introduced, but not discussed, see H. R. 9804, H. R. 10380, S. 3348, S. 2593—66th Congress, first session; H. R. 11206, H. R. 12134—66th Congress, second session; S. 4478, H. R. 16151—66th Congress, third session; H. R. 3718, H. R. 4395, H. R. 5219, H. R. 9184, S. 656, S. 2448—67th Congress; H. R. 10147, S. 3910—68th Congress, second session; H. R. 6516, H. R. 196, H. R. 4084—69th Congress, first session.

[53] Article I, Section 8, clause 3.

III

THE AIR COMMERCE ACT OF 1926. THE DEVELOPMENT OF ADMINISTRATION

The Air Commerce Act of 1926 became a law on May 20, 1926. It represents the cumulative effort of many organizations to secure Federal action in the encouragement and regulation of civil aeronautics. In its final form, the Air Commerce Act of 1926 was the result of the untiring efforts of Senator Bingham of Connecticut and Congressmen James S. Parker of New York, Schuyler Merritt of Connecticut, and Clarence F. Lea of California.[1] These men assumed the leadership in Congress in securing the final passage of Senate Bill 41.

The Constitutional Basis of the Act

The principal constitutional basis of the Air Commerce Act of 1926 is Article I, section 8, clause 3. (Congress shall have the power to regulate commerce with foreign nations, and among the several states, and with the Indian tribes.) It is important to note that Article I, section 8, clause 17, and Article IV, section 3, clause 2, are also utilized to extend jurisdiction over the District of Columbia and the territories. A portion of the Air Commerce Act reads as follows:

"As used in this act, the term 'interstate or foreign

[1] For a statement of the activities of these men see *Aircraft Year Book*, 1927, p. 5.

air commerce' means air commerce between any State, Territory, or possession, or the District of Columbia, and any place outside thereof; or between points within the same State, Territory, or possession, or the District of Columbia, but through the airspace over any place outside thereof; or wholly within the airspace over any Territory or possession or the District of Columbia."[2]

In addition to the three clauses cited above, there is an evident use of the war powers in section 5-f of the act permitting the Secretary of War to designate military airways, and in section 4 the President is authorized to set aside airspace reservations. The admiralty jurisdiction of the Federal Courts is invoked in section 11-b-c for any violation of customs, public health or immigration regulations. It provides, "Any civil penalty imposed under this section may be collected by proceedings in personam against the person subject to the penalty and/or in case the penalty is a lien, by proceedings in rem against the aircraft. Such proceedings shall conform as nearly as may be to civil suits in admiralty."[3]

In consideration of the constitutional basis of the Air Commerce Act of 1926, it may be noted that in 1921 the legal assistant to the Chief of the Air Service expressed the opinion that regulation of air traffic could not be legally accomplished under the present form of the Constitution. He recommended the passage of a constitutional amendment as an absolute necessity due to the common law maxim *Cujus est solum ejus est usque ad coelum.*[4] In the same year the Committee on Aero-

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[2] Public No. 254, 69th Congress, Section 1.

[3] *Ibid.,* Section 11-b. See also Article III, Section 2, clause 1 of the U. S. Constitution.

[4] Air Information Circular, Vol. 2, No. 181. "To whomever the soil belongs, he owns to the sky and also to the depths." 17 Corpus Juris 391.

nautics of the American Bar Association expressed a similar opinion: "The power to provide such complete, uniform control shall be conferred upon Congress by constitutional amendment and should not be seized in the guise of the exercise of existing powers."[5]

It is difficult to attribute very much force to such constitutional objections unless these gentlemen of the legal profession had in mind complete regulation of all aircraft, whether engaged in interstate or intrastate commerce. Since the Air Commerce Act of 1926 attempts, in most instances,[6] to regulate only interstate and foreign commerce, its constitutionality appears to possess adequate legal and historical backing.

There exists almost a direct analogy between Federal regulation of interstate railroads and Federal regulation of interstate aircraft. It is certain that the fathers of the Constitution had neither in mind when they inserted the clause in the Constitution giving Congress the power to regulate commerce between the states and with foreign nations.[7] Neither could these same fathers of our Constitution have had in mind such modern means of interstate transportation as pipe lines, telegraph, telephone, and radio transmission.

The flexibility of the "Commerce Clause" in its application was recognized as early as 1824 by Chief Justice Marshall in the case of Gibbons v. Ogden.[8] In 1877, the Supreme Court expressed the opinion that the powers of Congress over interstate commerce must "keep pace with the progress of the country and adapt them-

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[5] 46 Reports of American Bar Association 498.

[6] The exception is the compulsory observance of the Air Traffic Rules applicable to all aircraft. Section 11-a-5.

[7] Article I, Section 8, clause 3.

[8] 9 Wheaton 1.

selves to the new development of time and circumstances."[9] In the well-known Minnesota Rate Cases,[10] the court said, "Congress alone has power directly to regulate or burden interstate commerce and as to such direct burden or regulation the power of Congress is plenary, all pervading, exclusive and indivisible."

The preponderance of opinion expressed since the passage of the Air Commerce Act of 1926 indicates that the possibility of unconstitutionality is not of very great importance. One writer makes the flat statement, "There is no doubt that this law is constitutional. It has never been tested, and probably never will be."[11] Henry G. Hotchkiss in his book *Aviation Law,* feels quite certain that the "regulation of interstate flight is fully as defensible as the regulation of travel by railroad between the states."[12]

The Air Commerce Act of 1926 provides one compulsory rule which must be obeyed by all aircraft, whether engaged in interstate, intrastate or foreign commerce. Section 11-a-5 of the act provides that "It shall be unlawful to navigate any aircraft otherwise than in conformity with the air commerce rules." This section of the act might be contested in that the regulation of commerce within the state, which does not interfere with or affect interstate commerce, is a right reserved to the state governments.[13] The universal application of the air traffic rules to all aircraft of the United States is explained by the managers in a statement accompanying the Conference report of the House and Senate. "In order to protect and prevent undue burdens upon interstate and

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[9] Pensacola Telephone Co. v. Western Union, 96 U. S. 1, 9.
[10] 230 U. S. 352.
[11] Logan, Op. Cit. p. 34.
[12] Henry G. Hotchkiss, *Aviation Law,* p. 69.
[13] See Watkins on Shippers and Carriers, p. 153.

foreign air commerce the air traffic rules are to apply whether the aircraft is engaged in commerce or non-commercial, or in foreign, interstate, or intrastate navigation in the United States, and whether or not the aircraft is registered or is navigating in a civil airway."[14]

This statement indicates the probable defense of section 11-a-5 if a test case ever comes before the court. The Supreme Court of the United States has definitely stated in a number of recent opinions that Congress may regulate intrastate commerce when such regulation is necessary to prevent interference with the free flow of interstate commerce.[15] The Federal requirement of safety appliances on intrastate trains when operating on interstate tracks is a good example of this type of regulation.[16]

A case is now being tried before a Federal District Court involving a suit for injuries resulting from a violation of the five-hundred-foot altitude rule of the Federal Air Traffic Regulations.[17] The plaintiff failed to state whether the plane, at the time of the alleged injury, was engaged in intrastate or interstate flight. The defendant demurred to the complaint on the ground that the District Court had no jurisdiction. The court in overruling the demurrer held that the facts, as stated, made a prima facie case under the Air Commerce Act, that the case would not be dismissed by the Federal Court for lack of jurisdiction, and that whether the Air Commerce Regulations apply to intrastate flying can only be deter-

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[14] This statement is incorporated in Section 73 of the Air Commerce Regulations, effective as amended June 1, 1928.

[15] See State of New York v. U. S., 257 U. S. 591; Michigan Comms. v. Duke, 256 U. S. 570; R. R. Commrs. v. C. B. & Q. R. Co., 256 U. S. 563.

[16] Southern Rd. Co. v. U. S., 222 U. S. 20.

[17] Neismonger v. Goodyear Tire and Rubber Co., 1929 U. S. Av. R. 96 (N. D. Ohio 1929) also 78 U. of Pa. L. R. 5, p. 663.

mined by proof as to whether the regulation of intrastate flying is necessary to protect interstate flying.

Analysis of the Air Commerce Act of 1926

Jurisdiction

Seven different governmental agencies or departments are mentioned in the Air Commerce Act. Each one is empowered to perform some function or duty relative to the carrying out of the provisions of the act.

To the Commerce Department is entrusted the administration and enforcement of the major portions of the act. In section 8, an assistant secretary for aeronautics is created to carry on the duties assigned to the Commerce Department.

The President of the United States is authorized in section 4 to make necessary airspace reservations. To the Secretary of the Treasury is delegated the duty of providing regulatory rules for the entry and clearance and customs regulation for aircraft engaged in foreign commerce.[18] The Secretary of Labor is empowered to deal with all immigration problems relative to aircraft.[19] Meteorological information is to be supplied by the Secretary of Agriculture.[20] The Secretary of War is permitted to designate military airways.[21] Finally, the Bureau of Standards is directed to do such research and development work as tends to create improved air navigation facilities.[22]

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[18] Section 7-b. For a discussion of promulgated regulations see *U. S. Daily, United States Aviation Magazine,* March 8, 1930, p. 9. Regulations of the Treasury Department are contained in Department of Commerce, Aeronautics Bulletin No. 7-A.

[19] Section 7-d.

[20] Section 2-b.

[21] Section 6-f.

[22] Section 2-d.

The fundamental reason for this diversification of jurisdiction is apparent. Congress desired to utilize as many of the existing agencies as was possible, thus reducing to a minimum the necessity of creating new agencies. The enlargement of jurisdiction of the Interstate Commerce Commission by legislative enactments offers a parallel study.[23]

The Air Commerce Act is of especial importance because of its provisions declaratory of certain substantive rights of the Federal government. The act states in section 2 that the Federal Government has entered the field of regulation of aircraft for the purpose of promoting air commerce and "to encourage and regulate the use of aircraft in commerce." This declaration of policy would then appear to indicate that in so far as the Federal Government has assumed regulative control, conflicting state legislation is superseded by the Air Commerce Act.

In section 5-b, the Secretary of Commerce is given the authority "to designate and establish civil airways and, within the limits of available appropriations hereafter made by the Congress, (1) to establish, operate and maintain along such airways all necessary air navigation facilities except airports; and (2) to chart such airways and arrange for publication of maps of such airways, utilizing the facilities and assistance of existing agencies of the government so far as practical." The term "civil airway" is defined in section 9-j as "the navigable airspace designated by the Secretary of Commerce as a route suitable for interstate or foreign air commerce." The act defines "air navigation facilities" [24]

[23] The Hepburn Act, 34 Stat. at L. 584, extended I. C. C. jurisdiction to pipe lines; The Mann-Elkins Act, 36 Stat. at L. 539, extended jurisdiction to telephone, telegraph and wireless companies.

[24] Section 9-i.

as "any emergency landing field, light or other signal structure, radio directional finding facility, radio or other electrical communication facility and any other structure or facility used as an aid to air navigation."

Provision is made for the conversion of all government owned facilities to the free use of the public with the proviso in section 5-c that such navigation facilities "shall be made available for public use under such conditions and to such extent as the head of the department or other independent establishment having jurisdiction thereof deems advisable." In section 5-f, the Secretary of War is authorized "to designate routes in the navigable airspace as military airways."

The substantive right of sovereignty of airspace over the lands and waters of the United States is granted exclusively to the Government of the United States. Section 6-a provides, "That Congress hereby declares that the Government of the United States, has, to the exclusion of all foreign nations, complete sovereignty of the airspace over the lands and waters of the United States, including the Canal Zone. Aircraft, a part of the armed force of any foreign nation shall not be navigated in the United States, including the Canal Zone, except in accordance with an authorization granted by the Secretary of State." This section follows, in general, the provisions of the International Convention for the Regulation of Air Navigation,[25] which the representatives of the United States signed but the Senate failed to ratify. Article 1 of that convention provides that, "The high contracting parties recognize that every power has complete and exclusive sovereignty over the airspace above its territory."

[25] For full text see Henry G. Hotchkiss, *Aviation Law,* Appendix A.

Another section of the Air Commerce Act closely follows article 3 of the International Convention, "Each contracting party is entitled for military reasons . . . to prohibit . . . the aircraft of other contracting States . . . from flying over certain areas of its territory." Section 4 of the Federal act authorizes the President of the United States "to provide by executive order for the setting apart and protection of airspace reservations in the United States for national defense." In the same section the several states are also authorized to provide for airspace reservations "not in conflict with airspace reservations established by the President under this section or with any civil or military airway designated under the provisions of this act."

The definition of "Navigable Airspace" is important. It is defined in section 10 as airspace above the minimum safe altitudes of flight prescribed by the Secretary of Commerce in section 3, and such navigable airspace *shall be subject to a public right of freedom of interstate and foreign air navigation* in conformity with the requirements of this act."

Provisions for Regulation

In respect to regulatory provisions, the act may be termed an "outline act." In its terminology it does not attempt to lay down specific rules, but grants to the Commerce Department certain broad powers, the details to be worked out by the department through the issue of regulations. The act, then, possesses that desirable feature of flexibility and permissible change of regulatory features without additional legislation.

The principal regulatory features are contained in section 3 of the Air Commerce Act of 1926. The Secre-

tary of Commerce is assigned the duty of granting registration to aircraft, providing for the rating of aircraft as to their airworthiness and the subjecting of such aircraft to periodical examination.[26] He is also authorized to examine and rate airmen serving with aircraft of the United States as to their qualifications for such service.[27] Likewise air navigation facilities are to be examined and rated by the Secretary of Commerce.[28] Section 3-f gives him plenary power to issue, suspend or revoke registration of aircraft and certificates of airmen. Finally, the Secretary is authorized to "Establish air traffic rules for the navigation, protection and identification of aircraft, including rules as to safe altitudes of flight and rules for the prevention of collisions between vessels and aircraft." [29]

The generality of all the delegations of regulative authority is indicated by the foregoing paragraph. In the short period that the Air Commerce Act has been in effect, the wisdom of this feature has been indicated time and time again. It has allowed for the fullest adaptability of the regulations, embodying substantial modifications essentially necessary in the face of the rapidly changing conditions and the greater experience of the governmental enforcing agency.

Compilation and Dissemination of Information

In addition to the regulatory duties of the Commerce Department, it is charged with the authority to compile and disseminate certain types of information.

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[26] Section 3-a-b.

[27] Section 3-c.

[28] Section 3-d.

[29] Section 3-e.

The Secretary of Commerce is authorized to foster air commerce by studying the "possibilities for the development of air commerce and the aeronautical industry and trade in the United States and to collect and disseminate information relative therto and also as regards the existing state of the art." [30] He is further empowered "to make recommendations to the Secretary of Agriculture as to necessary meteorological service," [31] and "to advise with the Bureau of Standards . . . in carrying forward such research and development work as tends to create improved air navigation facilities." [32] Finally, the Secretary of Commerce shall "exchange with foreign governments through existing governmental channels information pertaining to civil air navigation," [33] and "investigate, record, and make public the causes of accidents in civil air navigation in the United States." [34]

Provision for Penalties

The Air Commerce Act of 1926 lists seven offenses, five punishable by fines and two by fine and imprisonment. The incorporation of these offenses in the Air Commerce Act has been necessary in order to enforce the provisions of the act. All of them are contained in section 11.

In section 11-a, the following acts are declared to be unlawful:

1. To navigate any aircraft within any airspace reservation otherwise than in conformity with the Executive orders regulating such reservation.

2. To navigate any aircraft (other than a foreign

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[30] Section 2-c.
[31] Section 2-b.
[32] Section 2-d.
[33] Section 2-f.
[34] Section 2-e.

aircraft) in interstate or foreign air commerce unless such aircraft is registered as an aircraft of the United States; or to navigate any foreign aircraft in the United States.

3. To navigate any aircraft registered as an aircraft of the United States, or any foreign aircraft, without an aircraft certificate or in violation of the terms of any such certificate.

4. To serve as an airman in connection with any aircraft registered as an aircraft of the United States, or any foreign aircraft, without an airman's certificate or in violation of the terms of any such certificate.

5. To navigate any aircraft otherwise than in conformity with the air traffic rules.

The above five acts or omissions are punishable by a fine of five hundred dollars, enforceable by action against the owner of the aircraft or as a lien against the aircraft itself.

Section 11-d provides that any person who fraudulently forges, counterfeits or alters any certificate issued by authority of the Air Commerce Act of 1926, or who knowingly attempts to use any such fraudulent certificate "shall be guilty of an offense punishable by a fine not exceeding $1,000 or by imprisonment not exceeding three years," or by both.

Lastly, the act provides a fine of not more than $5,000 or imprisonment not exceeding five years for any person guilty of displaying any false light with the intent of interfering with air navigation, or who removes, extinguishes or interferes with the operation of any true light or signal.[35]

[35] Section 11-e.

Definitions

The entire section 9 of the act is devoted to the defining of the terms used in the statute. Many of these definitions have already been given in this chapter. It is important to note that the term "citizen of the United States" means (1) An individual who is a citizen of the United States or its possessions, or (2) A partnership of which each member is an individual who is a citizen of the United States or its possessions, or (3) A corporation of which the president and two-thirds or more of the officers and the board of directors are citizens of the United States, and in which at least 51 per cent of the stockholders are citizens of the United tates.

This definition is of great importance in consideration of section 3-a, which provides that no aircraft shall be eligible for registration as an aircraft of the United States unless it is a civil aircraft *owned by a citizen of the United States.*

The term aircraft is defined as "any contrivance now known or hereafter invented, used, or designed for navigation 'in the air,' except a parachute or other contrivance . . . used primarily as safety equipment." [36] The term public aircraft means any aircraft used exclusively in the government service, while civil aircraft is defined as "any aircraft other than a public aircraft." [37]

A distinction is drawn in defining an airport and an emergency landing field. The former means any locality which provides facilities for shelter, supply and repair of aircraft; or a place regularly used for receiving and discharging passengers or cargo by air. The latter means any locality adapted for the landing or taking off of air-

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[36] Section 9-c.

[37] Section 9-d-e.

craft but not providing facilities for shelter, supply, etc., and not regularly used for the receipt or discharge of passengers or cargo.

An airman is defined as any individual who engages in the navigation of aircraft while under way or any individual who is *in charge of the inspection, overhauling, or repairing of aircraft.*

Two definitions found in section 1 of the act are of special importance in understanding the scope of the regulatory power granted to the Secretary of Commerce. The term "air commerce" means transportation in whole or in part by aircraft of persons or property for hire, navigation of aircraft in furtherance of a business, or navigation of aircraft from one place to another for operation, in the conduct of a business." "Interstate or foreign air commerce" is defined as "air commerce (for interpretation of term air commerce note definition above) between any state, territory, or possession, or the District of Columbia, and any place outside thereof; or between points in the same state, territory, possession, or District of Columbia, but through the airspace over any place outside thereof, or wholly within the airspace over any territory, or possession, or the District of Columbia." With these two definitions in mind, consider section 11-a which provides that "It shall be unlawful to navigate any aircraft . . . in interstate or foreign air commerce unless such aircraft is registered as an aircraft of the United States."

Compulsory Jurisdiction

It will appear from this analysis that the Secretary of Commerce may compel obligatory registration only upon aircraft engaged in "interstate or foreign air com-

merce" [38] and being operated as a common carrier, or "in the furtherance of a business," or "being used for the transportation of persons or property for hire," or being operated "from one place to another in the conduct of a business." Saying the same thing in another way, an aircraft operated solely for pleasure, even in interstate or foreign commerce, need not be registered as an aircraft of th United States, or subjected to any tests to determine its airworthiness.[39] Neither is an aircraft engaged in any business pursuit but operated solely in intrastate commerce required to be subjected to Federal registration or tested to determine its airworthiness. This narrow restriction of compulsory Federal jurisdiction, is, in the opinion of the writer, the most serious defect of the Air Commerce Act of 1926. It should be unlawful to fly an unairworthy aircraft under any circumstances, whether engaged in interstate, intrastate or foreign commerce, whether being operated commercially or solely for pleasure.[40]

Prohibitions

The Air Commerce Act contains three prohibitions of a negative nature. Section 3-a provides that only aircraft owned by a citizen of the United States may be registered as an aircraft of the United States. This section has the effect of barring aircraft owned by foreign citizens or foreign corporations from participating in any interstate business pursuit. This prohibition applies even if the foreign owner is a resident of the United States, or if the domestic corporation owner is composed

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[38] Note definition above of this term.

[39] Except in so far as state regulation might require such tests.

[40] Under the present Federal law, state legislation is necessary to accomplish this object.

of officers and stockholders not of sufficient number to comply with the two-thirds and 51 per cent definition contained in section 9-a.[41] Section 6-b-c stipulates that foreign aircraft "shall be navigated in the United States" only if authorized by the Secretary of the Commerce Department, such authorization to be granted only "if a foreign nation grants a similar privilege in respect of aircraft of the United States . . . but no foreign aircraft shall engage in interstate or intrastate commerce."[42] These sections of the Air Commerce Act would not bar a Canadian Company from operating a mail or passenger line from Montreal to Dallas, Texas (providing Canada granted reciprocity to the United States aircraft), but such business would have to be entirely of a foreign commerce nature. The Canadian Company could not engage in any interstate or intrastate commerce along the route. That these sections of the statute will act as a definite check on foreign route penetration in the Unied States is quite evident. Without questioning advisability of these prohibitions, it would be well for the transport operators of aircraft in the United States to hope that neighboring countries of North and South America do not adopt similar provisions in their respective national regluatory statutes for aircraft.

The third prohibition is contained in section 7-a. It provides that "the navigation and the shipping laws of the United States . . . including the rules for the prevention of collisions . . . shall not be construed to apply to seaplanes or other aircraft or to the navigation of vessels in relation to seaplanes or other aircraft."

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[41] Cf. *supra* p. 42.

[42] Section 6-c.

Air Commerce Regulations

Section 3 empowers the Secretary of Commerce to promulgate, provide, and enforce air commerce regulations. Pursuant to this authority such regulations were prepared by the Commerce Department in conjunction with the various aviation business interests. Questions involving the extent, type, and stringency of the regulations had been the subject of considerable controversy during the year 1926. Many pilots, manufacturers and operators felt that too much regulation would have the effect of stagnating progressive development rather than encouraging it.[43]

On August 11, 1926, President Coolidge appointed William P. MacCracken, Assistant Secretary for Aeronautics. Mr. MacCracken was a prominent Chicago lawyer, Chairman of the Committee on the Law of Aeronautics of the American Bar Association. He had been interested in aviation for many years, serving during the war as pilot and flying instructor in the Army Air Service. Mr. MacCracken proved to be an admirable choice for the difficult task of organizing the administration of a new phase of governmental activity.

Prior to the promulgation of the Air Commerce Regulations, the new Assistant Secretary for Aeronautics and his assistants made a close study of the International Air Navigation Convention, which regulates all civil flying in Europe. Their survey included consideration of the mistakes made by the regulative agencies of Europe as well as the major problem of favorable development of commercial aviation in the United States.

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[43] For expression of some of these opinions see, "What Pilots Think About Air Legislation," *Aviation,* January 18, 1926, p. 84; January 25, 1926, p. 116; February 1, 1926, p. 154; February 15, 1926, p. 224; March 1, 1926, p. 301; March 22, 1926, p. 416; see also editorials in *Aviation,* September 27, 1926, p. 584 and October 26, 1926, p. 701.

A tentative set of regulations was drawn up by the Commerce Department and submitted to a special committee of the Aeronautical Chamber of Commerce appointed to study the proposed rules.[44] This committee, after careful study of the tentative draft, submitted a report to the Commerce Department suggesting changes which they believed would secure more favorable treatment for the aeronautical business interests and greater simplification in administration and interpretation.

Adopting a policy similar to the Trade Practice Submittal of the Federal Trade Commission, Mr. MacCracken called a conference of the representatives of the Aeronautical industry to confer with the Department of Commerce. A series of seven meetings were held during October of 1926.[45] A blanket invitation was extended to all aviation interests to attend the meetings and express their viewpoints on the licensing of pilots, the qualifications of commercial planes and kindred matters. Each meeting was devoted to a special group of aviation interests, i. e. manufacturers of airplane motors, manufacturers of airplanes, air mail contractors, those interested in special flights and sightseeing, insurance companies, and publishers.

The proposed regulatory features were discussed rule by rule and constructive modifications were suggested, criticisms offered, and deletions urged by the assembled delegates. Committees were appointed from among the delegates. These committees, in conjunction with the representatives of the Department of Commerce, prepared a redraft of the Air Commerce Regulations. This redraft was approved by the conference and

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[44] See *Aircraft Year Book*, 1927, published by the Aeronautical Chamber of Commerce of America, p. 10.

[45] Dates of meetings, October 4, 6, 8, 11, 13, 18, 22 at Washington.

adopted by the Department of Commerce to become effective on December 31, 1926.[46]

This first issue of the Air Commerce Regulations contained six chapters as follows:

Chapter 1—The Licensing of Aircraft.

It defines the scope of the law and exemptions, the technical requirements of airworthiness, and the detailed procedure for obtaining a license.

Chapter 2—Marking of Licensed and Unlicensed Aircraft.

Prescribes the type of identification marks to be employed by aircraft.

Chapter 3—Requirements in the operation of aircraft.

Requires periodic inspection of licensed aircraft, prescribes safety equipment necessary on licensed arcraft, and regulations requiring accident reports.

Chapter 4—Licensing of Pilots and Mechanics.

Classifies pilots into four groups, specifies type of examinations to determine qualifications.

Chapter 5—Air Traffic Rules.

Establishes air traffic rules for navigation of aircraft.

Chapter 6—Miscellaneous.

Provides method of reporting violations of the Air Commerce Act by the violator after the penalty has been inflicted for mitigation or remission. Section 90 of this chapter allows the Secretary of Commerce to waive any requirements of these regulations if the particular facts justify such a waiver.

The desirability of elasticity of the regulations was soon demonstrated and these original set of regulations were amended, in part, on March 22, 1927 and July 1, 1927.

A second conference of representatives of the vari-

[46] For report of these conferences see *U. S. Daily*, 1926, page index, 2617:7, 2649:1.

ous aeronautical interests was called by the Department of Commerce on December 5, 1927. In explanation of this meeting, the Commerce Department issued a statement as follows: "The experience of the past year has indicated the necessity of certain changes in the regulations and for the consideration of other related matters of equal importance. Following the established policy of the Department, the conference is for the purpose of obtaining the advice and coöperation of those interested in its activities, before definite action is taken." [47]

This conference was attended by over 300 representatives of the aviation industry from all sections of the United States. The chief topic of discussion at this conference was the adoption of the proposed handbook for commercial airplane designers. This handbook was intended to set up certain compulsory guides or standards in the manufacture of aircraft. Such regulation was strongly opposed by a minority group of the delegates. Chief among the opposition was Clarence D. Chamberlin of transatlantic fame, who stated, " We all want to be left alone as much as possible. . . . It isn't that we fear the restrictions of those in office now. They are helping us in every way. What we are afraid of is that some day some politician who knows nothing about the business may be placed in office and do us a great deal of harm. I believe that matters of design should be left to the builders; that the manner in which they work out their problems should be left to them. Let the government rule on the safety factors and let us meet the tests through the rigid sand test of other practical means. Then if we fall down it is our own funeral." [48]

[47] *Domestic Air News,* Vol. I, No. 15, p. 16.

[48] *New York Times,* May 12, 1927. Others who opposed the handbook were Paul Henderson of National Air Transport Co., William Stout of the Ford Motor Co., and R. B. C. Noorduyn of the Atlantic Aircraft Corporation.

A committee was designated to consider the proposed handbook. This committee reported it favorably to the conference, recommending a number of minor changes. Other matters discussed were a proposal to subdivide the transport pilot license into five classes according to the gross weight of the plane to be flown, a proposal to prohibit the use of war surplus aircraft from commercial operation,[49] the advisability of prohibiting passenger planes from operating from other than a licensed field, the need for governmental regulation or rating of flying schools, the necessity for Federal rating or zoning of airports with reference to size and facilities offered, etc.[50]

The result of this conference was the substantial revision of the Air Commerce Regulations effective, as amended, June 1, 1928. This set of regulations contained eight chapters following in general the subject matter of the six chapters in the 1926 set of regulations but subdividing chapter three of the 1926 regulations into chapters two and three of the 1928 regulations, entitled respectively, "Inspection of Aircraft" and "Operation of Aircraft." Chapter four of the 1926 regulations is also subdivided into two chapters in the 1928 regulations, chapters five and six, entitled respectively, "Licensing of Pilots" and "Licensing of Mechanics."

This brief summary of the two conferences with the aeronautical industry will indicate the general method employed by the Department of Commerce in promulgating the Air Commerce Regulations. That the method employed has been the greatest factor in securing the fullest coöperation of the industry is almost unquestioned.

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[49] This proposal was virtually shouted down.

[50] For full discussion of the proceedings of this conference see *Aviation*, December 19, 1927, p. 1458 et seq. Also *United States Daily*, 1927, page index, 2839:7, 2851:2, 2867:6, 2881:6, 2895:1.

Frank P. Bell, Manager of the Varney Air Lines said of the 1927 conference, "MacCracken has been a godsend to us fellows out in the mountains, and at this conference we had an interchange of ideas that was, for me at least, one of the biggest experiences of my fifteen years in aviation. We learned that the Department was not there to tell us things, but to ask our opinion on aviation problems and then act." Frank A. Tichenor, Editor of the *Aero Digest,* said that one of the most striking things about the conference was the intense interest of the new manufacturers in the advancement of the standards of the industry. Sherman M. Fairchild expressed the opinion that, "The conference certainly accomplished what it desired to do, and that was to bring the entire industry together for the discussion of problems that were vital to all concerned." [51]

Organizing the Aeronautics Branch

On September 23, 1925, Hon. Herbert Hoover, then Secretary of the Department of Commerce, outlined a complete plan of organization for a branch of the Department of Commerce to handle commercial aviation. This plan suggested eight months before the passage of the Air Commerce Act was substantially followed in the organization of the Aeronautics Branch of the Department of Commerce in 1926 and 1927.

Mr. Hoover proposed that most of the work of the governmental agency designated to promote and regulate commercial aviation could "be undertaken by the extension of existing bureaus of the Department of Commerce which have already an overhead and directing staff of such work in all parts of the country." He continues, "In other words, we could extend the work performed by

[51] *New York Times,* December 12, 1927.

the Lighthouse Service, the Coast Survey, the Bureau of Standards, the Weather Bureau, etc." [52]

It is important to note that the Air Commerce Act of 1926 did not create a new bureau in the Department of Commerce. It was intended that the functions of the Department outlined in the act were to be performed by existing agencies as far as was feasible.

The Lighthouse Service was assigned the duty of establishing, maintaining, and operating aids to navigation along the air routes. In order to correlate this work, an Airways Division was established in the Lighthouse Bureau. The mapping of air routes was assigned to the Coast and Geodetic Survey. To facilitate this work an Airways Mapping Section was set up in the organization of this part of the Commerce Department. The Bureau of Standards was augmented by an Aeronautics Research Division whose function is to carry out the research work of the Department of Commerce pertaining to aviation. In the Bureau of Mines there was established a Helium Section.

These four functions of the Department of Commerce were saddled on already existing agencies. To carry out two additional functions, namely, the examination of aircraft and airmen and the dissemination of information, it was necessary to set up new instrumentalities. Accordingly, two special divisions were established, the Division of Air Regulations and the Division of Information.[53]

For the first six months of operation the work of the respective divisions was directly supervised by the Assistant Secretary for Aeronautics, but on July 1, 1927,

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[52] United States President's Aircraft Board, I, 323.

[53] The name of the "Division of Information" was changed to the "Division of Airports and Aeronautic Information" and on November 11, 1929 to the "Aeronautic Information Division."

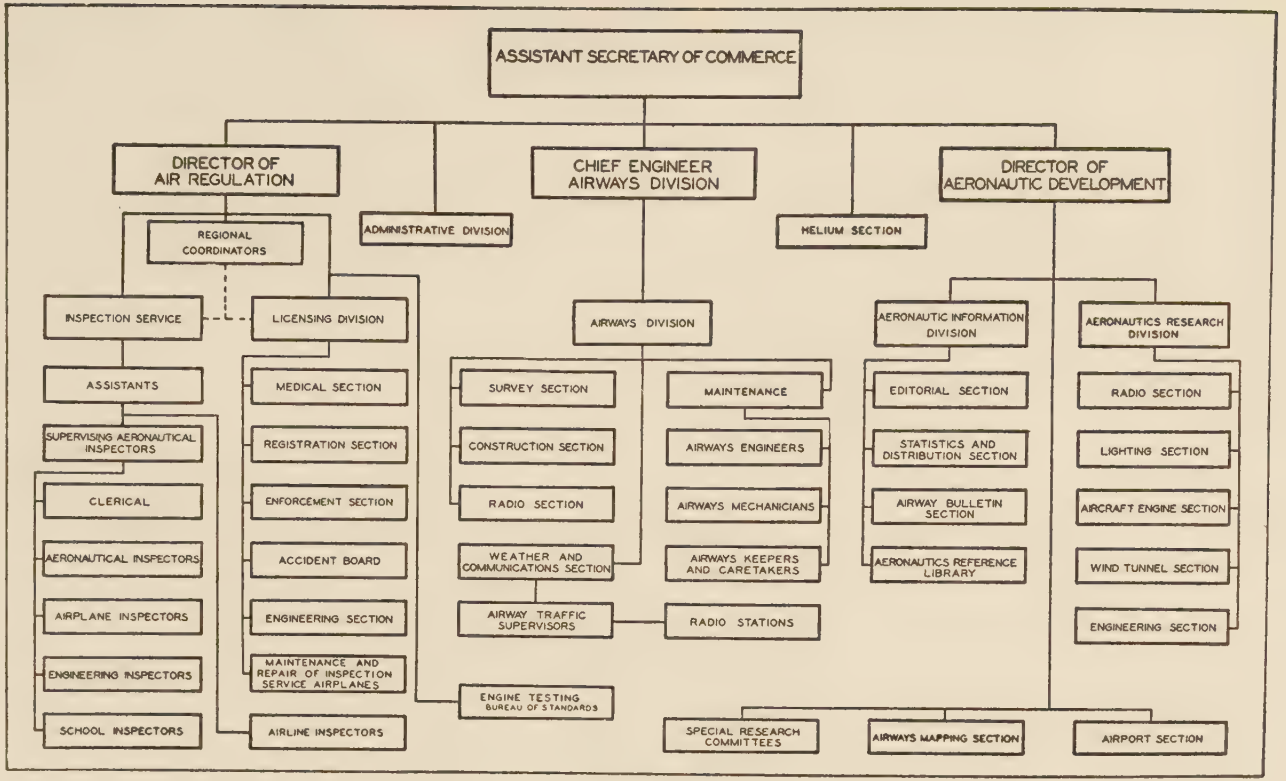

CHART I

Organization of Aeronautics Branch

the Secretary appointed a Director for Aeronautics who was placed in immediate charge of the Commerce Department's work under the Air Commerce Act.

The seventh office of the Department of Commerce dealing with the Air Commerce Act was designated as the Administrative Section. This section handles matters of personnel, purchasing, and other administrative details.

For purposes of convenience, the Airways Division of the Lighthouse Service, the Airways Mapping Section of the Coast and Geodetic Survey, the Aeronautics Research Division of the Bureau of Standards, the Helium Section of the Bureau of Mines, the Division of Air Regulations, the Division of Information, and the Administrative Section, are collectively called the Aeronautics Branch of the Department of Commerce. Its present organization is shown in Chart I.

One major change has been made in this organization. Because of the extreme demands made upon the Commerce Department due to the rapid development of civil aeronautics in the United States and in an effort to better the service offered the industry, it was deemed advisable to divide the responsibilities resting upon the Director of the Aeronautics Branch between two executives. In addition to the Airways Division under a Chief Engineer, the work of the Branch are now classified into two main groups: (1) Licensing and Inspection activities, (2) Aeronautic Development Service. The executives heading each of these groups are respectively termed the Director of Licensing and Inspection and the Director of Aeronautic Development.[54]

[54] This division of executive responsibility was effected on November 11, 1929.

Administrative Section

This section is the coördinating unit between the Assistant Secretary of Commerce for Aeronautics and the fiscal and personnel administration of the Aeronautics Branch. It serves also as the clerical agency of the Aeronautics Branch in its relations with the other offices of the government. Its function, as stated by the Chief of the Section,[55] consist of the following:

1. It serves as the employment agency of the Aeronautics Branch in conjunction with the Civil Service Commission.

2. It supervises the accounts and finances of the Aeronautics Branch. All estimates and contracts must be approved by the Administration Section.

3. All supplies not purchased through the Supply Bureau are contracted for by the Administrative Section directly.

4. It accounts for all property of the entire Department, approves and prepares requisitions, and maintains a store room.

5. It serves as the clerical agency for compiling the budget of the Aeronautics Branch for the Budget Bureau.

It will be seen from the above functions that the Administrative Section is the coördinating agency for the Aeronautics Branch in its own internal administration as well as for its external relations with other governmental offices.

Summary

There seems to be little doubt that Federal Regulation of interstate commerce is a valid exercise of the commerce power of Congress. The provision of the Air

[55] Mr. S. W. Crosthwaite.

Commerce Act requiring all aircraft to conform with the air traffic rules may be contested.[56] Do the air traffic laws apply to and govern flights purely intrastate? In the case of Neismonger v. Goodyear Tire and Rubber Co.,[57] the Federal District judge said they probably do. "If the circumstances and conditions under which air commerce is carried on are such that it is necessary for the altitude rule to apply to and regulate intrastate flights in order to protect interstate movements, then it will so apply the same as to an interstate flight. . . . It is apparent that all or nearly all of these rules (air traffic) must be applied to both intrastate and interstate craft in order to secure the safety of the latter, and that with respect to these matters, the federal regulation must be paramount. Conflicting state rules could not be allowed." The court has allowed itself certain discretion in future decisions. It is apparent that all of the air traffic rules need not apply to intrastate flights, if such application is not necessary to "secure the safety" of interstate flights.

As indicated, the Air Commerce Act is an "outline" act. It possesses the ideal advantage of flexibility. The wisdom of permitting regulative details to be changed by the agency responsible for the administration has been proven to be highly advantageous for such a dynamic subject of regulation as civil aeronautics. In drafting the regulations, the Department of Commerce has again exercised considerable foresight in constantly consulting the representatives of the industry.

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[56] Section 11-a-5.

[57] 35 Fed. (2nd) 761. For notes on this case, see 78 U. of Pa. L. Rev., 663, and 1 Journal of Air Law, p. 359.

IV

THE REGULATION OF AIR COMMERCE

Having considered the provisions and the administrative development of the Air Commerce Act of 1926, let us examine the specific organization of the Aeronautics Branch which enforces the regulative features of the act. The principal objective of all such Federal regulation is the promotion of aeronautic development. The Department of Commerce believes that an essential to such promotion is the assurance to the public that every effort is being made to offer the safest aviation facilities that present day aeronautical research and regulative provisions can guarantee.

The only alternative to governmental regulation is the complete technical education of every single individual who uses, or intends to use, the services of any aeronautical activity. This is obviously impossible. If the public is entitled to protection against unscrupulous transport operators and plane manufacturers, it is much simpler to educate the public to recognize a few markers required on those aircraft which meet the Department of Commerce "airworthy" requirements, and to assure competent pilotage of such planes by making it illegal to operate them without a Federal pilot's license.

To protect the public who wish to fly, the capitalist who desires to invest, and those responsible persons and corporations who wish to manufacture and operate airworthy aircraft, it is essential that some impartial agency determine and enforce a code of minimum safety standards. In brief, this code, enforced by the Department

of Commerce, has become licensed planes, flown by licensed pilots, in conformity with Federal air traffic rules.

Air Regulation Division[1]

This Division, under the executive control of the Director of Air Regulation, was organized to assume responsibility for activities without precedent, designed to aid the aviation industry and to protect the public by regulating air navigation. It has, therefore, been the task of this Division to determine and to enforce definite standards of safety. It has thus played a large part in the phenomenal growth of the aircraft industry and air commerce by establishing and maintaining public confidence.

The work of the Division includes:

1. The inspection of aircraft for airworthiness and their registration as aircraft of the United States.
2. The examination and licensing of airmen and mechanics serving in connection with licensed aircraft.
3. The identification and numbering of all aircraft, including those not licensed.
4. The investigation of accidents.
5. The enforcement of the air traffic rules.

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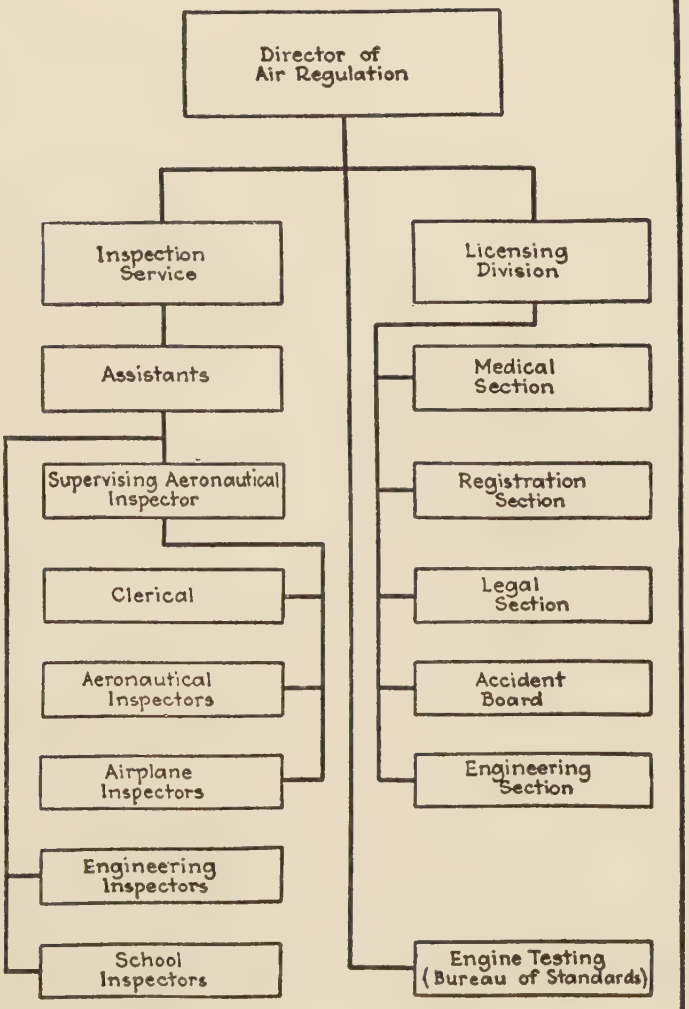
[1] Most of the descriptive material contained in this chapter is based on a personal study by the author of the operation of the Aeronautics Branch. During this study every section and division chief, as well as the Director of the Aeronautics Branch and the Assistant Secretary of Commerce for Aeronautics were interviewed. The personnel of the Aeronautics Branch also permitted the author to have access to the files of the various offices. Sources of information of a controversial nature will be noted except in those instances where the interviewed personnel have requested that authorship be not divulged. This study was principally conducted between August 23 and September 4, 1929. Information obtained through interviews will, for purposes of brevity, be footnoted by giving the name and position of the person interviewed during that period. Unless otherwise stated it is to be assumed that such interviews occurred during the period mentioned above. For organization see Chart II.



Organization Chart of the regulatory activities of the Aeronautics Branch. These activities, together with Airways and Aeronautic Development are under direct supervision of the Assistant Secretary of Commerce for Aeronautics.

CHART II

6. The rating of flying schools.

7. The promulgation and revision of the regulations.

To accomplish these various phases of its work, the Division has been divided into, first, the Inspection Service, and second, the Licensing Division. All of the various types of inspectors are supervised by the Inspection Service. The Licensing Division is divided into various sections, Medical, Registration, Legal, and Engineering and an Accident Board.

The Inspection Service

The inspectors of this Service contact the aviation public more closely than any other personnel of the Aeronautics Branch. It is therefore of vital importance that these inspectors be chosen with unusual care. An examination of the functions of the Inspection Service will indicate their close relationship with the public:

1. The examination and licensing of mechanics, pilots and flying instructors.
2. The inspection and approval of airplanes.
3. The rating of flying schools.
4. The enforcement of the Air Commerce Regulations.
5. The investigation of aircraft accidents.

Types of Inspectors

As now organized, the Inspection Service employs the use of three types of pilot inspectors and one type of inspector not necessarily a pilot. The pilot inspectors include:[2]

[2] Mr. G. S. Marriott, Chief of Inspection Service.

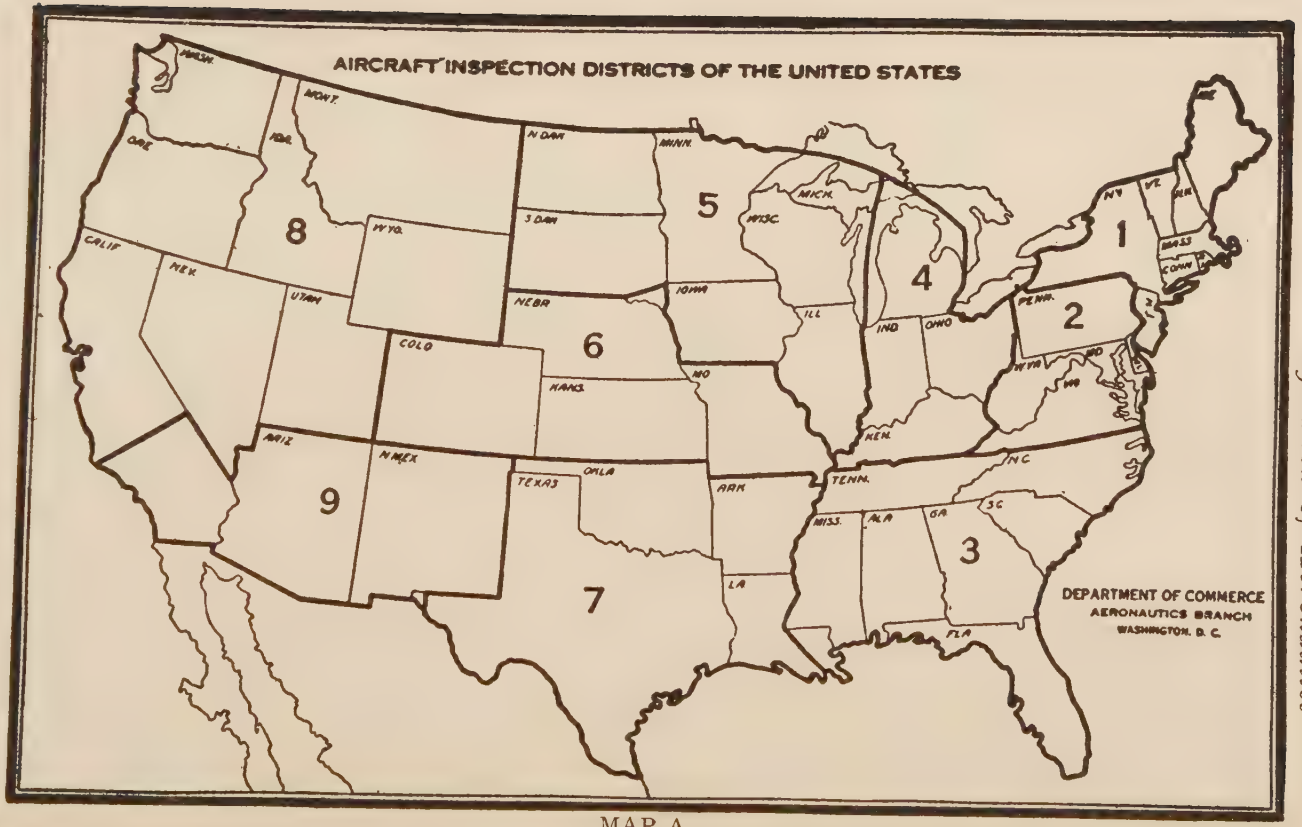
1. Aeronautical Inspectors, directly concerned with the examination of pilots and the inspection of aircraft for original and for renewal of licenses. These inspectors are under the direct control of supervising aeronautical inspectors who are in charge of the nine principal inspection districts into which the United States is divided. (See Map A.)

2. Aeronautical Engineering Inspectors, charged with the inspection and flight testing of new types of aircraft to determine the eligibility of such aircraft for a license or an approved type certificate. They are also engaged in the factory inspection of the various aircraft factories producing the planes they flight test as well as the repair and service station facilities offered by the manufacturer or his distributors.

3. Aeronautical School Inspectors, assigned the duty of examining and flight testing flying school instructors and the inspection of flying schools to determine their eligibility for a Department of Commerce approved school certificate.

All of the types of inspectors described above are, directly or indirectly, operating under the supervision of the nine supervising aeronautical inspectors. Because of the close contact of these men with the aeronautical industry great care is taken in their selection. The minimum requirement of these pilots in flying experience is 750 hours. They must also possess a thorough knowledge of airplanes and airplane construction. In order to insure mature judgment, inspectors are not usually selected under thirty years of age. The very nature of their work in meeting the public and carrying out their duties in the inspection of airplanes and pilots implies the necessity of the exercise of much tact and diplomacy.[3]

[3] Mr. Gilbert G. Budwig, Director of Air Regulation.


AIRCRAFT INSPECTION DISTRICTS OF THE UNITED STATES
WASH.
OREG.
CALIF.
NEV.
IDAHO
MONT.
WYO.
UTAH
COLO.
ARIZ.
N.MEX.
N.DAK.
S.DAK.
NEBR.
KANS.
OKLA.
TEXAS
MINN.
IOWA
MO.
ARK.
LA.
WISC.
ILL.
MICH.
IND.
OHIO
KEN.
TENN.
MISS.
ALA.
GA.
FLA.
S.C.
N.C.
VA.
W.VA.
PENN.
MD.
DEL.
N.J.
N.Y.
VT.
N.H.
MASS.
CONN.
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DEPARTMENT OF COMMERCE
AERONAUTICS BRANCH
WASHINGTON, D. C.

MAP A

The one type of non-pilot inspectors are termed Aeronautical Engineering Inspectors. They are under the direct supervision of a supervising factory inspector. These men are not operating on itineraries but are permanently located at the various airplane factories. Their entire time is devoted to the minute inspection of aircraft during the progress of construction and license such aircraft immediately upon their satisfactory completion at the factory.

The Rate of Turnover of Inspector Personnel

On January 1, 1930, Mr. J. S. Marriott, chief of the Inspection Service reported a total of fifty of the flying type of inspectors and sixteen of the non-flying or factory inspectors.[4] These men are in great demand by the aviation industry and the turnover has been exceptionally high. This situation is due to two major factors:

1. The high qualifications necessary to obtain either type of inspection position.

2. The valuable training they receive while serving as inspectors.

An inspector constantly engaged in the testing of all types of aircraft will gain much valuable information concerning their general flying characteristics, spinning tendencies, stalling speed, etc. This information is of great value in the manufacturing of aircraft. As a result, many of the inspectors are induced to leave the Inspection Service and accept positions at much higher salaries with the aeronautic industry.[5]

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[4] This represents an increase in personnel of five and one respectively over the period ending June 30, 1929.

[5] Mr. S. W. Crosthwaite, Chief, Administration Section.

To prevent this high rate of turnover, all inspectors are employed with the understanding that unless discharged for cause they will remain with the service for a period of one year. The present salary scale for pilot inspectors ranges from $3500 to $4400 per year. This scale appears to be exceptionally low considering the hazards of the occupation. Almost all of the inspectors have been through many narrow escapes while testing applicants for pilot's licenses and while flight testing new types of aircraft. In a very interesting article on the Inspection Service, Donald E. Keyhoe says, "One inspector was landed in a tree by an applicant when the engine cut out; another had a woman applicant bring in a plane upside down; several inspectors have been put in power spins close to the ground, and others have been stalled at dangerously low altitudes."[6] That this description is not exaggerated is attested by the fact that two of the inspectors lost their lives in this work during the fiscal year ending June 30, 1929. It would seem that an immediate revision of the salary scale on a higher level would be justifiable in consideration of the hazardous flying necessitated in the work of the pilot inspectors. Such a revision would have the additional advantage of retaining in the service a greater number of the responsible and trained type of personnel.

Need for Additional Personnel

The most cursory investigation of the daily activities of the pilot inspectors indicates an immediate and urgent need for increased personnel. In September of 1929, the author had occasion to check their work in the Philadelphia and Chicago districts. Many of the inspectors were

[6] *Aviation*, May 25, 1929, p. 1794.

working ten to fourteen hours per day in a strenuous effort to keep pace with the work assigned them. On December 1, 1929, the Inspection Service began the practice of renewing all grades of pilot's licenses in the field on the basis of the new pilot's classification. This classification requires that all passenger carrying grades of pilots hold a rating for the weights and types of aircraft in which they desire to carry passengers for hire. This necessitates a large increase in the work of the pilot inspectors. The investigation of aircraft accidents is another task assigned to these inspectors. This work is of vital importance to the aviation interests, but, during 1928 and 1929, the inspectors scarcely had time to investigate those accidents in which fatalities occurred.[7] Regardless of fatality occurrence all accidents are of equal importance. The primary interest involved is the cause and not the result. With the tremendous increase in flying predicted for the near future, it is evident that the number of accidents will likewise increase.

It is a strange paradox that pilot inspectors, generally covering a territory of three or four states, must in many cases, travel from airport to airport by train. The Aeronautics Branch has frequently requested additional planes for the use of the inspectors, but so far has succeeded in obtaining only fifteen planes, a ratio of one for every four inspectors. The bulk of the work of the inspectors is performed at the various airports. It is quite evident, therefore, that the availability of more planes would greatly increase the speed with which an inspector could cover his itinerary. Countless hours of their time now wasted in train travel could be utilized in inspection work.

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[7] Mr. E. P. Howard, Chief of Licensing Division.

The Licensing Division[8]

For purposes of expediting the licensing work of the Aeronautics Branch, this Division has been divided into five administrative groupings: the Medical, Registration, Legal, and Engineering Sections of the Accident Board. With the object of clarifying the functions and the special problems of each of these groupings, it would seem advisable to consider them separately.

The Medical Section

This Section consists of a Medical Director and over 1000 designated examining doctors throughout the United States. The latter are charged with the duty of personally examining every applicant for a pilot's license or a student's permit, and periodically re-examining those pilots already licensed.

Examining physicians are paid a fee of fifteen dollars for each examination of applicants for the transport license. Dr. Bauer, the Medical Director of this Section, estimates that the examination for the transport license, if properly performed, should consume about two hours time. The fifteen dollar fee, paid by the applicant and retained by the doctor for his examination services, would, therefore, give the physician a rate of pay averaging seven and one half dollars per hour. This compensation may appear low, but it must be considered that the greater number of the medical examinations are for the private and limited commercial types of licenses. These examinations can be completed in forty-five minutes and the fee is ten dollars.

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[8] Mr. E. P. Howard, Chief of Licensing Division.

Increase in Work

The work of the Medical Section has increased greatly during the past year. The examinations completed in the fiscal year of 1929 had expanded two and one half times over the number completed in the fiscal year of 1928.

The following table will indicate the growth. The fiscal year, June 30 to June 30, is used.[9]

	1927-28	1928-29
Original examinations, trained pilots	6,567	3,709
Re-examinations, trained pilots	1,242	8,013
Students, original examinations	4,379	16,756
	12,186	
Deduct 500 for 1926-27	500	
Totals	11,688	28,478

The decrease in the number of original examinations of trained pilots in 1928-29 is due to the fact that during 1927-28 all pilots having training were given original examinations for their Department of Commerce license. These men have now all been licensed and the new holders of Federal licenses have already received their original examination as a student flyer. These men are therefore listed in the reexamination column when they are examined for a Department of commerce license of a higher classification than private pilot.

Dr. L. H. Bauer has prepared a table indicating the increase in the number of examinations of all classes coming into the Medical Section at Washington. Figures are given by quarters and to the nearest one hundred:

[9] Figures supplied by Dr. L. H. Bauer, Chief of the Medical Section.

	1927-28	1928-29
1st quarter	1700	6500
2nd quarter	2100	5700
3rd quarter	2400	7000
4th quarter	4500	9000

Dr. Bauer states that the figure for the fourth quarter of 1928-29 of nine thousand, does not include approximately twenty-five hundred examinations received by his Section but not checked because of inadequate personnel to handle them. He estimates that his Section will receive about 45,000 to 50,000 applications during the fiscal year 1929-30.

On June 30, 1929, the number of medical examiners was 704. By June 30, 1930, the number had increased to 1000.[10] There is an immediate need in this Section for increased office personnel to handle the rapidly increasing work of checking incoming examination reports.

Much valuable research could be accomplished by the Medical Section in correlating physical fitness of pilots and safety. No important figures have so far been devised indicating the factor of the pilot's physical condition as the cause of accidents. Such a study has far reaching possibilities. Certain it is that good physical condition, not only of pilots, but weather reporters, mechanics, and even factory airplane workers, plays a vital part in insuring a greater degree of safety in air transport. The Medical Section has recognized the need for such research but has been forced to neglect this work in order to care for the increasing amount of detailed clerical work necessary.

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[10] Figures of Dr. L. H. Bauer, Chief, Medical Section.

Better Supervision Essential

From an administrative point of view, the chief problem of the Medical Section is the co-ordination of the activities of over 1000 medical examiners through a single office in Washington. The Medical Director at Washington has only a correspondence acquaintance with over fifty per cent of his examining physicians. The examiners are even employed by mail.

Dr. Bauer[11] has suggested as a remedy for this situation the appointment of District Flight Surgeons located throughout the United States. Each such Flight Surgeon would be in charge of a designated district. These men would keep in constant contact with the examiners in their respective districts. He suggests that at the outset five districts could be formed and a flight surgeon could be put in charge of each of the five districts. His plan would accomplish four favorable results:

1. It would permit a personal interview with every prospective medical examiner by a representative of the Aeronautics Branch.

2. It would afford an opportunity to teach the examiners the special technique required in giving a pilot's physical examination.

3. It would give the Medical Section an opportunity to check the efficiency and thoroughness of the medical examiners.

4. The plan would tend to standardize examinations throughout the United States.

Other advantages of Mr. Bauer's plan are obvious. It would permit periodical meetings of the Flight Surgeons to discuss methods of examining, the policy of granting waivers to pilots with slight physical defects,

[11] Chief of the Medical Section.

and other suggestions designed to increase the general efficiency of the Medical Section. It would also be possible to hold meetings of the local examiners, under the supervision of the District Flight Surgeon, to obtain valuable information and advice as to method and policy from the men who are actually performing the examinations in the field.

The Engineering Section

The Engineering Section of the Licensing Division is charged principally with the duty of determining the airworthiness of aircraft which are to be made eligible for Federal license. The organization of this section consists of a chief and assistant chief, eight aeronautical engineers and a clerical force. The entire organization is located at Washington.

Approved Type Certificate for Aircraft

To facilitate the licensing of aircraft of identical design and construction, a system of granting approved type certificates to aircraft manufacturers has been created.[12] The approved type certificate, popularly called the A.T.C., authorizes the manufacturer to build aircraft of exact similarity to the model approved by the Engineering Section.

The procedure in obtaining an A.T.C. requires the manufacturer to submit complete technical data, stress analysis and blue prints of his aircraft. This data is reviewed by the Engineering Section and carefully checked to determine that the submitted design conforms to the required margin of safety and adheres to accepted

[12] For full details of airworthiness requirements, consult Aeronautics Bulletin No. 7-A.

engineering practice. The minimum engineering requirements of the Aeronautics Branch have been outlined in detail in "The Handbook for Airplane Designers," issued by the department on October 1, 1927. The handbook was revised and reissued June 1, 1928, under the title "Requirements for Approved Type Certificates for Airplanes, Engines and Propellers." Revision was again necessary in 1929 to keep pace with the rapid development of design and construction of aircraft, engines and propellers. The latest revised requirements became effective July 1, 1929.

The actual checking of technical data submitted by the manufacturer requires the services of aeronautical engineers well versed in all the mathematical processes for analysis and design of aircraft. These men have been very difficult to obtain and greater difficulty is experienced in retaining their services. The great demand for aeronautical engineers by the industry, presenting opportunities for much more profitable employment, has caused a 100 per cent turnover each year among the engineers employed in the Engineering Section.[13]

Before an airplane is granted an approved type certificate it must undergo various tests conducted by the Inspection Service. These tests include a structural check to determine if the plane is built according to the design submitted, a practical flight test to check for stability in the air and possible undesirable flying characteristics, and a factory inspection to determine the adequacy of personnel and equipment to produce aircraft similar to the design submitted. Upon the satisfactory completion of all of these tests the manufacturer is granted an approved type certificate for that particular model. This model will then be approved for license as long as the

[13] Mr. K. S. Lane, Chief, Engineering Section.

manufacturer utilizes good workmanship and materials in its manufacture and adheres to the specifications of the approved design. Summarizing, before a manufacturer can obtain an approved type certificate for any particular model of aircraft,

1. The engineering data must be checked and approved.

2. One airplane built according to specifications must pass inspection and a flight test.

3. The manufacturer must show the existence of facilities in his factory to produce duplicates of the model receiving the approved type certificate.

Criticisms of Engineering Section

The Engineering Section of the Licensing Division has borne the brunt of much criticism from the aeronautical industry, some of it just, much of it unjust. Whereas the refusal by the Inspection Service to grant a single plane or pilot a license entails only a small financial loss of the usage of a single plane or the services of one pilot, the Engineering Section, by delaying or refusing the granting of an approved type certificate, may cause the cessation of activities in an entire factory. The loss to the manufacturing company may be very large.

Delay in granting approved type certificates has always been a source of trouble between the aeronautic industry and the Engineering Section of the Aeronautics Branch. There are many causes for this condition. Primarily the Engineering Section is under-manned. In the Fall of 1929, Mr. K. M. Lane, chief of this Section informed the writer that his Section was at that time three weeks behind in their stress analysis checking, and this was the nearest the Section had ever approached

the position of being current with their work. The existence of this situation means that engineering data on new models of aircraft, upon which the manufacturer is seeking an approved type certificate, must lie in the offices of the Engineering Section three weeks before it ever starts its journey toward its approved type certificate goal. Appropriations allowing greater personnel for this Section would solve at least this portion of the delay problem. The manufacturing interests would be well repaid by an earnest attempt to educate Congress and the Budget Bureau on the necessity for such appropriations.

The great number of engineers leaving the Section for more lucrative positions in the industry has also had its effect in slowing up efficiency.[14] The government can hardly compete with the industry on a salary basis. The "gentleman's agreement" has been used in retaining personnel for a period of one year. As a solution to the problem, providing appropriations could be secured, Mr. Lane has suggested the creation of a training school with a quota of two recently graduated engineers. These men could be trained by the older personnel in the methods and practice of checking engineering data. Their services could also be utilized in preparation of research work requiring the assembly and compilation of data. Mr. Lane's plan, providing for trained replacement personnel, would assist materially in maintaining the efficiency of the Section.

The industry itself is responsible for much of the delay in the granting of approved type certificates. Many manufacturers appear to be turning out hastily prepared

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[14] Nine engineers including the Chief of the Section left the department during the fiscal year 1928-29. *Aviation* presented the question, "Is commercial aviation robbing government services, universities, and important research bureaus of their trained personnel?" Fifty responses to this question were highly controversial. See *Aviation,* December 14, 1929, p. 1168.

stress analyses in an effort to satisfy the Department rather than make an adequate analysis study to insure the airworthiness of their product. Many submitted designs contain serious errors. The determination of stress analysis is a progressive series of mathematics, an error near the beginning ruins most of the results. The Engineering Section is unable, under such circumstances, to determine the safety of the airplane design submitted. The data must be returned to the manufacturer for correction of errors, then returned to the Section and rechecked. A delay of this nature is attributable only to the carelessness or haste of the designer.[15]

The Aeronautics Branch has set forth in great detail the methods of construction and minimum requirements of conventional aircraft. Every manufacturer is supplied with a copy of this bulletin. Despite this the Engineering Section receives a great number of analyses which are not in conformity with that publication. It would appear that many designers either fail to read the bulletin or else insist upon their own particular method of analysis. These variations tend to confuse the analysis and in most cases appear to have no advantage over the methods and requirements of the Aeronautics Branch.

The Engineering Section reports many other causes of delay. "Many analyses which may be entirely correct, both as to method and arithmetic, are so incompletely presented as to either render checking impossible or to omit important investigations. In such instances, the Department is forced to ask for explanations and await their receipt." The report continues, "In some instances delays have arisen because of the peculiarities and new features of a particular design. Neither the manufacturer nor anyone else possessed sufficient actual test data

[15] See article by K. M. Lane, *Aviation*, January 25, 1930, p. 154.

upon which to base design calculations. The Department was forced to ask for static tests which would demonstrate that the manufacturers assumptions or guesses were safe. It would seem that the manufacturer would perform these things of his own accord in order to insure the safety of his product and thus avoid throwing the burden of additional work and correspondence upon the shoulders of the Department."[16]

At the September 1929 meeting of the Aeronautical Chamber of Commerce held at Cleveland, several criticisms of a different nature were voiced by the representatives of the aeronautical industry.[17] "It was evident that the general desire was for stability in the Department's exactions and procedure, rather than (that) the rules should take any particular form. Various manufacturers expressed themselves as wishing to be safeguarded, either against sudden changes in airworthiness regulations which would upset production schedules or against arbitrary enforcement of personal ideas by individual inspectors." This criticism is a real one, when it is considered that the first set of minimum standards for guidance to manufacturers in aircraft production and designing was issued in October of 1927, the second in June of 1928 and the third in July 1929. The Aeronautical Chamber of Commerce has advocated and finally secured the approval of the Commerce Department in providing that the Department will, in the future, issue a revision of the airworthiness requirements once each year and that this revision will be effective each year on January 1. In reference to arbitrary enforcement of personal ideas by individual inspectors, the manufacturers expressed a desire that individual inspectors should be guided by an inspection manual which would set forth in detail the

[16] *Domestic Air News,* No. 39, p. 7.
[17] Reported in *Aviation,* September 7, 1929, p. 510.

scope of the inspector's authority and the manner in which he was to exercise it.

There has always existed an undercurrent of objection to any regulations specifying minimum requirements to be satisfied in aircraft construction.[18] The general feeling of this element in the industry is that structural design and inventive genius have been hindered by the requirements set up by the Commerce Department. The Department has maintained that minimum requirements must be set up and enforced to insure safety. The Aeronautics Branch asserts that this does not mean that a radical or new type of design cannot be approved so long as the structure is justified, either by mathematical computation or actual physical tests. Regardless of the relative merits of the two lines of argument, several of the more recent objections to the minimum requirements seem to be worthy of consideration. It would seem most advisable that the Aeronautics Branch should proceed very carefully in the adoption of detailed standards and requirements in aircraft designing.

At the September 1929 meeting of the Aeronautical Chamber of Commerce, the strongest feeling was expressed on the Department's rulings covering the stability and spinning requirements of aircraft. The Department had required that all planes applying for an approved type certificate shall come out of a spin in one and one half turns after having made six turns. The general feeling of the meeting was that it was of more importance to build a plane with freedom from the liability of falling into a spin than to build a plane that possessed the ability to remain in a spin for a long time and then recover quickly from that spin. The objection seems especially valid in cases where it is necessary to engage in involved

[18] See *U. S. Daily*, December 5, 1927, objections voiced against adoption of "Handbook for Airplane Designers."

and abnormal manipulations of the controls in order to produce a spin for the sole purpose of determining whether the plane will recover in one and one half turns after having completed six turns.

In commenting on the entire question of minimum requirements, an editorial in *Aviation* states, "It is easier to pass safety regulations affecting design than it is to repeal them, and it will not be long before the civil handbook controls commercial airplane design as thoroughly as the Army and Navy handbooks control military design. Such a condition would in our mind be deplorable."[19]

This editorial criticism contains much truth, but the exacting attitude of the Engineering Section seems to be justified to a great extent. In the short time that Federal regulation has existed there has been built up a high degree of reliance and faith in the Aeronautics Branch, not only by the industry, but by the general public as well. The public must place its confidence in some unbiased agency. That agency is the Aeronautics Branch. The more important duty of the Aeronautics Branch is the protection of the general public. A single mistake in granting an approved type certificate to an unairworthy craft would seriously undermine that public trust which the Aeronautics Branch now enjoys.

Approved Type Certificate for Aircraft Engines

All engines used in approved type certificate aircraft must also receive an approved type certificate from the Engineering Section. [20] All engine testing is being performed by the Bureau of Standards. While the Engineering Section is technically responsible for the granting of an approved type certificate, it does none of the routine

[19] *Aviation,* June 15, 1929, p. 2061.

[20] For detailed requirements of engines receiving an approved type certificate, see Aeronautics Bulletin No. 7-A, p. 64.

work of checking engine specifications or actual testing of engines on the torque stand.

The present equipment of the Bureau of Standards consists of one four hundred horsepower electric dynamometer at the Bureau of Standards in Washington and three torque stands at College Park, Maryland. As the cooling of radial air cooled engines in the laboratory is still in the experimental stage, practically all the tests so far conducted have been made on the torque stands at College Park. Provision is made for the acceptance of engines for approved type certificate that have successfully passed the regular endurance tests of the Army Air Corps and the Navy Bureau of Aeronautics.

The primary purpose of the granting of approved type certificates for aircraft engines is to guarantee the use of dependable, durable and efficient motors in airworthy and safe airplanes. To accomplish this end, the Bureau of Standards has worked out a routine procedure for engine testing.

Briefly described, this test consists of definite preliminary requirements and an endurance block test. The manufacturer is required to supply a starter for his engine, if the engine is not regularly equipped with one, and run the motor for twenty-five hours developing during that run a horsepower average not less than one-half the rated power of the motor. A log of this preliminary run at the factory must be supplied the Engineering Section.

The endurance block test is now conducted at College Park by the Bureau of Standards. Some of the early tests were made at the factory by the manufacturer under the direct supervision of an engineer of the Bureau of Standards, but this method of testing has been discontinued.[21] The block test consists of a fifty-hour endurance

[21] The Warner (R-420) was tested at the factory in Detroit.

run in ten five-hour periods.[22] The failure of a major part of the engine during the test would bar the granting of an approved type certificate. Upon the completion of the fifty-hour run, tests are made to determine the curve of power against speed by varying the load with throttle wide open. A tear-down and detailed inspection of engine parts is made immediately following the block test.[23] The recommendation of the Bureau of Standards is forwarded to the Aeronautics Branch for the grant or denial of an approved type certificate.

Criticisms on Engine Testing

From an administrative point of view many defects are discernible in a forced relationship of an old established bureau and a newly created Aeronautics Branch. Congress, in an effort to save money, shunted the task of conducting engine tests upon the Bureau of Standards rather than create a new agency to perform this work in the Aeronautics Branch. There are various indications that seem to show that the present arrangement is not all that could be desired. The Aeronautics Branch grants approved type certificates for engines, the Bureau of Standards tests these engines, and the administrative relationship between them appears to be rather superficial. On the basis of personal observation and interviews with the personnel of the Bureau of Standards and the Aeronautics Branch, the writer would suggest the transfer of all engine testing work to the Aeronautics Branch. Such a transfer would create unified control and coördinated effort in engine testing. It would likewise create unified responsibility for delays in granting approved type certificates.

[22] A more detailed description is contained in Air Commerce Bulletin, Vol. I, No. 17, p. 1 et seq.

[23] See Aeronautics Bulletin No. 7-c.

The problem of delay in securing approval of an engine has been exceptionally irritating to the airplane motor manufacturers. This delay has been caused principally by inadequate equipment at the Bureau of Standards, and secondly, insufficient testing by the manufacturer in his own shops, with the result that the engines often broke down repeatedly in the first few hours of testing by the Bureau. No serious thought is involved in the solution of either of these problems. The Lycoming Engine Company solved the question of inadequate equipment by shipping to Washington not only their engine but a torque stand and complement of their own engineers and mechanics to set up their engine for test. The Lycoming Company received an approved type certificate in approximately one week's time.[24] Such a procedure is not being recommended by the writer, but indicates that much of the slowness in testing is due to inadequate equipment.

All engines are now being tested at Washington. Even if adequate equipment is supplied in Washington for testing purposes, the present arrangement will not be satisfactory to manufacturers in other parts of the country. California, for example, is developing a large number of engines that have to come all the way to Washington to be tested. If a minor breakage should occur long delays are necessitated while parts are being shipped. The development of good suitable engines is a vital factor in safety and if the government wishes to make its tests a help instead of a hindrance to the industry it should provide adequate facilities in various parts of the country. It would seem that this decentralization could be handled with greater ease if engine testing was put under the complete control of the Aeronautics Branch.

[24] Test completed August 18, 1929. Information given to author by K. M. Lane, Chief of the Engineering Section, August 26, 1929.

Approved Type Certificate for Propellers

Safety being the primary object of all Federal regulation, it is just as important to guarantee durability of propellers as it is to inspect motors for dependability and aircraft for airworthiness. The Engineering Section has therefore provided for the granting of approved type certificate for airplane propellers. Every airplane licensed by the Department of Commerce must be equipped with a propeller of an approved design.

Most all of the testing of propellers to date has been done by the army or navy testing equipment. These tests have been accepted by the Engineering Section for the granting of an approved type certificate. The Bureau of Standards has no equipment for the testing of propellers. In lieu of an army or navy test the Commerce Department will accept propeller drawings with the data on which the manufacturer bases his request for approval. These drawings must be accompanied by an affidavit that the propeller has been flown for one hundred and fifty hours without failure on an engine of equal or greater power than that for which the approval is sought.

Inasmuch as commercial aviation is being so rapidly developed, many of the propellers manufactured in the future will not be tested by the army or navy. A "whirl test" on a stationary internal combustion engine or on electrical apparatus would seem to be more advisable and more satisfactory than the present affidavit procedure based on flight testing. The "whirl test" also has the advantage of allowing almost any degree of overloading and would further give an exact test of the strength of the propeller because the propeller could be run until a breakage occurred. The procurement of facilities for the Bureau of Standards to make these tests would be a valuable investment in safety.

During the fiscal year, June 30, 1928, to June 30, 1929, 121 approved type certificates were granted for airplanes, 21 approved type certificates were granted for engines, and 28 approved type certificates were granted for propellers. The total number of approvals granted to airplanes, engines, and propellers was 248. This total includes the examination of 65 different types of airplanes and 13 types of engines which were approved for license without the granting of approved type certificate. Most of these airplanes and motors were manufactured for experimental purposes. The increase in work of the Engineering Section may be noted by a comparison with the previous fiscal year in which only 72 approvals were granted.

The Registration Section

This Section is the clerical agency for the Licensing Division. It is responsible for the preparation and issuance of all aircraft, pilots', and mechanics' licenses and their renewals, for the transfer of title of aircraft which have received Department of Commerce numbers, for the issuance of certificates of airworthiness for export for aircraft to be shipped to a foreign country having reciprocal agreements with the United States for the validation of such certificates, and for the maintenance of all files and records pertaining to the above.

As indicative of the constantly increasing mass of detail that the Registration Section must handle, compare the statistics for the past two years. During the fiscal year ending June 30, 1929, a total of 42,338 licenses, license renewals, title transfers, and export certificates were issued as against a total of 14,083 for the previous fiscal year. This represents a 300 per cent increase in output. The number of student permits issued showed

an increase of 477 per cent in a like comparison of these two periods. For every one hundred students only about fifteen ever get beyond the student stage. This low percentage is not indicative of the percentage of students who are unable to learn to fly. It more clearly indicates a large group of persons who are interested in obtaining first-hand information on the principles of flying. As Mr. Jesse W. Lankford[25] points out, there are many aeronautical engineers who have no desire to learn to fly skillfully and yet desire to know the problems of the pilot. There also exists a large group of individuals who, for personal reasons, desire to accomplish a solo flight. The increase in the volume of work of the Registration Section has created the constant problem of reorganizing and minimizing office routine in order to keep the issuance of licenses current. The result has been the creation of one of the most efficient clerical forces in governmental employ. Complaints are still very plentiful but many of them are due to carelessness or lack of knowledge of the regulations by the public. Mr. Donald E. Keyhoe, formerly of the Aeronautics Branch, describes a typical instance of a man who had bought a second-hand plane and desired to use it immediately in interstate commerce. "He sends a telegram to the Department of Commerce: 'Wire me temporary license by Waco bought from John Jones. Send L———— Airport by tomorrow morning to cover trip already contracted for then.' The Department of Commerce cannot take a chance on licensing a plane without establishing ownership, eligibility of plane for license, and citizenship of owner. If it sent numbers out indiscriminately on such requests it would be easy to steal planes and 'trade' without any record. So it wires back (some government departments

[25] Then Chief of the Registration Section, interviewed by the author, August 25, 1929.

would write) : 'Department must have type, serial number, and proof of ownership. See Air Commerce Regulations for detail. Letter follows.' The owner is indignant. His trip is off and he has lost money—all because of a 'finicky bunch of red-tape artists at Washington.' He says so, loudly, and his friends agree that he has had a raw deal. It is easy to criticize the Government, and a popular pastime."[26] The writer is convinced from a perusal of similar correspondence received by the Department that Mr. Keyhoe's[27] description is not exaggerated.

Decentralization

As a possible remedy for the type of complaint described above, there seems to be no good reason why the entire clerical activities of the Registration Section should be concentrated in Washington. At present a license application for a pilot's license would follow along this rather circuitous course. If the applicant lived in Los Angeles, he would send his license application to Washington. There it would be checked for errors, medical approval, etc., the application would then be forwarded to the Supervisor of the Inspection District in which the applicant desires to be examined, in this case to district No. 8 on the west coast. After examination by the inspector in Los Angeles, the application and graded examinations would be returned to Washington, where, after a further checking for completeness, the license would be mailed direct to the applicant.[28] Much of the time now consumed in mailing correspondence from distant points to Washington could be eliminated by locating licensing offices at strategic points in the

[26] *Aviation,* May 18, 1929, p. 1694.
[27] See Section 5 of Uniform State Law.
[28] Mr. Jesse W. Lankford, Chief, Registration Section.

United States. It would probably be most logical to place one of these offices in each of the nine inspection districts. Applications received could then be directly turned over to the local district supervisor.

Dr. Bauer has recommended field flight surgeons for the district supervision of medical examiners, trade papers have frequently urged the establishment of several locations in the United States for engine testing, and it would seem that the Registration Section would increase its efficiency considerably by a geographical division of its activities. It is not difficult to vision in the very near future the complete decentralization of most all of the activities of the Licensing Division.

The Time Payment Plan as Affected by Ownership Status

The development of the time payment plan of merchandising aircraft has presented another difficulty requiring immediate solution.[29] The Air Commerce Regulations provide that aircraft must be registered in the name of the owner. Many finance companies demanded that title be reserved in them until all payments were made, until they became cognizant of the fact that this retention of actual title would make them absolutely liable for all damages caused by the plane in those states that had adopted the Uniform State Law.

To secure compliance with the Air Regulation, and at the same time assure some measure of relief to the finance companies, the Department of Commerce insisted that the purchaser have title to the plane to be registered, but further provided that the finance company could give notice of a lien to the Department. This lien notice did not require the signature of the purchaser which would

[29] For a discussion of the problem from the point of view of the Aircraft Industry, note *Aero Digest,* January, 1930, p. 76.

have served as his acknowledgment of the existence of the lien.[30]

It would be possible to modify the regulations and allow an applicant to register a plane if he could show an interest rather than ownership. Mere loan or lease would show an interest. The actual ownership would be unknown to the Department unless a corps of lawyers were employed. The sale of aircraft would be hindered where the Department was unable to advise a prospective purchaser as to who the owner was on the Department's records. Such information could not be supplied if a variety of instruments such as chattel mortgages, certified bills of sale, trust agreements, etc., were used. Another objection would be the untenable position of the Department when parties disagreed on the question of ownership.

Mr. R. S. Paulett of the Licensing Division has spent considerable time in working out the problem to the satisfaction of the Department and the finance companies. His plan, as presented to the Finance and Insurance Section meeting of the Aeronautical Chamber of Commerce in September 1929, was, with minor changes, adopted by the Department of Commerce. It provides that the applicant must submit a clear bill of sale to the airplane before a license will be issued. However, a license will be issued stamped "Subject to Lien" if an affidavit is submitted by the finance company, properly signed by the title holder. In Mr. Paulett's original plan he had suggested that the liens be executed on forms specified by the Department of Commerce. Under the present system, the affidavit form is only suggested by the Department. When an airplane has been fully paid for, a release is executed in the form of

[30] The history of this problem was presented to the writer by Mr. R. S. Paulett of the Registration Section, Interview, August 24, 1929.

an affidavit signed by the finance company. Until such a time as the release of a recorded lien is received by the Department, all licenses issued on the plane are stamped "Subject to Lien," whether the plane changes hands in the meantime or not.

In commenting on the value of the present method of recording liens, Mr. Paulett, in a letter to the author, stated, "If you contemplated the purchase of an airplane, the Department could not state definitely whether or not a lien exists on the plane, but would be in a position to state whether or not a properly recorded lien exists on our records."[31] Putting it a little more bluntly, Mr. Paulett implies that the Department of Commerce is unable to require, under the present law, the recording of all liens with the Aeronautics Branch, and that on any individual airplane the Department would be unable to tell whether or not a valid lien, of which the Department has no notice, exists in one of the states.

This defect may not seem of great importance at the present time, but it is certain to cause much confusion when aircraft become so numerous that a sizable used plane market becomes necessary. It would seem advisable to pass legislation which would have the effect of making ownership status of all planes readily available to prospective purchasers. The plan of registering liens with the Department of Commerce could be made the groundwork for such legislation. It might be suggested that this type of legislation for aircraft take the general form of the Marine Act of 1920 which makes invalid, except as between immediate parties, any transfer of ships not recorded with the Department of Commerce. Similar legislation for aircraft should prove of great value to not only the finance companies, but the industry in general.

[31] Correspondence, January 8, 1930.

The Legal Section

The enforcing of the Air Commerce Act of 1926, the Air Commerce Regulations and the Air Traffic Rules is delegated to the Legal Section. It prepares the assessment of penalties and acts in a general advisory capacity in matters pertaining to air law.[32]

Prior to July 1, 1927, violations of the air commerce regulations were handled by a reprimand rather than the assessment of a civil penalty, or suspension, or revocation of license as provided for in the Air Commerce Act.[33] This procedure was adopted because it was felt that violations were caused by lack of knowledge or misunderstanding of the regulations rather than willfulness.

The Legal Section does not maintain a field force to search for violations, but adopts an objective attitude of allowing complaints to come to their attention. Four most common sources of information relative to violations come to the notice of the Legal Section through,

1. Reports of violations by the Field Inspectors of the Inspection Service.

2. Complaints voiced by individuals, verbally or by letter.

3. Reports of violations by state authorities.

4. Reports of accidents coming into the Regulations Division sometimes indicate violations.

During the fiscal year ending June 30, 1929, the Section reported 493 violations, 176 assessments of civil penalties, 76 suspensions of licenses, 21 revocations of licenses, 6 denials of licenses, 192 reprimands, $4,525.00

[32] Mr. E. McD. Kintz, Chief, Legal Section.
[33] Section 3-f.

collected in fines, 6 public hearings and 12 cases referred to the Department of Justice.[34]

Civil assessments are levied by the Secretary of Commerce on the recommendation of the Chief of the Legal Section, who bases his recommendation upon the report of the Field Inspector's investigation or his own personal investigation.[35] Appeals by violators of the regulations from the Department's rulings, and legal enforcement of the Department's assessments, are referred to the Department of Justice.

Revocation and suspension of licenses of both aircraft and pilots is provided for in the Air Commerce Act of 1926.[36] Ten grounds for revocation or suspension of aircraft licenses are cited in the Air Commerce Regulations,[37] and ten causes are cited for revocation or suspension of pilot's licenses.[38] Section 3-f of the Air Commerce Act permits the applicant for or holder of a license to file a written request with the Secretary of Commerce for a public hearing to be held within twenty days of the revocation, suspension or denial of a license. All of these hearings until September 1929 were conducted by the personnel of the Aeronautics Branch connected with the Washington office. Since then, hearings have been conducted by Supervising Field Inspectors of the Inspection Service.

The Air Commerce Act of 1926 provides for two offenses with criminal penalties attached. They are

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[34] Annual Report of the Director of Aeronautics for 1929. During the calendar year 1929, a total of 523 violations were handled by the Aeronautics Branch. Fines were assessed for 179 of these violations and the amount collected was $4,755; 53 cases were dismissed for lack of evidence; 163 pilots were reprimanded and 110 licenses were suspended.

[35] Five offenses are punishable by assessment of civil penalties. See Section 11-a of the Air Commerce Act.

[36] Section 3-f, Air Commerce Act.

[37] Section 24, Air Commerce Regulations.

[38] Section 62, Air Commerce Regulations.

forging, counterfeiting, or altering any certificate issued by the Aeronautics Branch, and displaying any false light or signal which would interfere with navigation.[39] All violations of these offenses are prosecuted by the Department of Justice. There were two prosecutions involving forged licenses during the fiscal year 1928-29. The penalty for the first offense is a fine not exceeding $1,000, or three years imprisonment, or both. The second offense is punishable by a fine not exceeding $5,000, or five years imprisonment, or both.

The Enforcement Section serves also as an advisory agency on matters pertaining to air law and air legislation. It has assisted in the preparation of State legislation covering aeronautics, and passed upon State bills proposed on this subject, as well as advising State and other authorities, both verbally and by correspondence, in the endeavor to have uniform State aeronautical legislation enacted.[40] It has made frequent interpretations of the Federal Regulations and has published these interpretations in the *Domestic Air News* and the *Air Commerce Bulletin*.[41]

During the period of regulation, the violations of the Air Commerce Regulations have consisted of acrobatics over prohibited areas, flying low over congested areas, flying licensed aircraft without a pilot's license, flying aircraft with no identification numbers displayed, flying without navigation lights; in fact, practically every one of the air traffic rules was violated.[42] The Legal Section has been exceptionally lenient with violators. It is the intention of the chief of the Section to stringently

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[39] Section 11-d-e.

[40] Aeronautics Bulletin, No. 20. See Information Bulletin, No. 41 of Aeronautics Branch.

[41] *Domestic Air News*, No. 52.

[42] A description of the air traffic rules is set forth in Department of Commerce, Aeronautics Bulletin, No. 15.

enforce the regulations during 1931. His decision is very advisable. There will always exist a small minority in the aeronautical business upon whom coercion is necessary to secure compliance.

The Accident Board

This Board was appointed by the Director of the Aeronautics Branch in July of 1928 for the purpose of making an analysis of all aircraft accidents occurring in the United States to allocate causes for such accidents.[43] The comprehensive and uniform system for analyzing aircraft accidents, as worked out by the National Advisory Committee, was adopted as the method to be employed by the Accident Board.[44] It was the original intention of the Director to have all accidents come before this Board for analysis. This plan soon proved impractical because of the great amount of time required of the executive personnel of the Air Regulations Division who were also occupied with the regular duties of their respective Sections. The major portion of the work was therefore delegated to a specially skilled employee. Only those accidents involving difficult and comprehensive analysis are now referred to the Board. In order to derive the benefit of men skilled in all phases of causations of accidents, the Board is composed of two trained pilots, two lawyers, one aeronautical engineer, one flight surgeon and one statistician. With this personnel any contributing factor to an aircraft accident is covered by expert knowledge.

The statistics gathered from the work of this Accident Board have proven of great value in serving as a check against the efficacy of the various regulatory

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[43] *Aviation*, July 2, 1929, p. 32.
[44] National Advisory Committee for Aeronautics, Report No. 308.

provisions. They have shown exactly the points that must be stressed in regulation to reduce accidents. The Board's work has served as a check also on the engineering functions of the Division. Repeated structural failures or unfavorable flying characteristics of certain planes have been forcibly brought to the attention of the Engineering Section by means of the accident reports. The discovery of the great number of accidents, due to personnel, has resulted in the introduction of new methods of licensing passenger-carrying pilots and caused the organization of a system of rating flying schools.

All regulation is directed toward greater safety. Accident analysis work has not received the amount of attention that it deserves. It has repeatedly proven itself fundamentally necessary as a yardstick for present regulatory provisions and as an indicator of the need for new provisions. The accuracy of the Accident Board's analysis directly hinges upon the accuracy and completeness of accident reports received from the field. The investigation of and reporting on accidents is only one of the field inspector's many duties. These men are at present almost entirely occupied with their inspection duties. The result has been that accident reporting has not received the attention that its importance to the public demands. The same general situation pertains to the investigation of violations of the Air Commerce Regulations and Air Traffic Rules involving reckless and dangerous flying on the part of pilots.[45]

Publicity of Accident Findings

It has been the policy of the Department of Commerce to refuse to make public any information concerning an individual airplane accident. It has undertaken

[45] Opinion of Mr. E. McD. Kintz, Chief, Enforcement Section.

to compile composite statistics every six months on all the accidents occurring during the period. This policy of secrecy has been strongly attacked in the Senate because of lack of public information on several serious air transport accidents occurring during the latter part of 1929 and the first two months of 1930.

In defending the policy of the Aeronautics Branch, Major Clarence M. Young, Assistant Secretary of Commerce, makes this statement: "No provision was made in the Air Commerce Act of 1926 for the Aeronautics Branch to conduct formal hearings, subpoena witnesses, take testimony under oath, or engage in any other practices necessary to bring out the pertinent facts underlying accidents in civil aviation which could be made public as soon after the accident as possible. With the authority and machinery we have available, we determine the facts about aircraft accidents from voluntary and visible sources in the most thorough manner permitted by the circumstances. I believe that if the authority now granted under the Air Commerce Act for the investigation of aircraft accidents were augmented by a provision precluding the admission of official accident reports as evidence in civil suits and authorizing formal investigations of accidents if and when preliminary informal investigations of a given accident made such a hearing necessary or advisable, much of the alleged mystery as to why aircraft accidents occur would be removed. However, as this procedure cannot be followed under the authority and facilities now available, we must turn to the next best method which, after all, enables everyone concerned with the development of aeronautics to proceed along the course leading to unquestioned safety."[46]

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[46] Major Young is here referring to the bi-annual reports of the Aeronautics Branch. *Aviation,* February 8, 1930, p. 258.

Senator Bratton of New Mexico claims that the Department of Commerce has sufficient authority at the present time to make public the findings of its experts on accidents if it desired to do so. "The Department originally construed the act of compelling it to make public its findings and did so in a number of cases, but when that action evoked a storm of protest from operators and pilots, the Department changed its attitude, discontinued complying with the law, and began the practice of making semi-annual or annual reports in which accidents were set out in classes or categories."[47] Senator McKellar of Tennessee adds, "In other words, when owners protested, the Department simply disregarded the law absolutely and undertook to repeal it and did repeal it."[48]

Both the arguments for and against accident publicity possess some merit. It might be argued for complete publicity that nothing so inspires public confidence as the frank facing of the facts. In addition, it might be said that the lessons of a transport accident are of great value to all operators. In opposition to a full publicity policy, it might be stated that the responsibility for efficient regulation lies with the Department of Commerce. It would therefore be of prime importance that the Department be able to get all the facts as quickly and as accurately as possible. Lack of positive information on a specific accident is a frequent occurrence. As Mr. E. P. Warner points out, "The Department itself often has to speculate in its report, for lack of positive infor-

[47] *Ibid.*, p. 259.

[48] *United States Daily*, February 15, 1930. In reference to this declaration, note the statement of Attorney General W. D. Mitchell, "The entire content (Section 2-e) of the Section discloses the intent to leave matters of detail to the discretion of the Secretary of Commerce, subject to the general requirement that the means adopted must be such as to 'foster air commerce.'" See *U. S. Daily, U. S. Aviation Magazine*, March 8, 1930, p. 3.

mation. Where the sole object is to extract information useful in avoiding a recurrence of the accident, it is quite permissible that the plot be filled in by as much guessing as necessary. In a report destined to be a public record, such a course would be inexcusable."[49]

As a possible solution to the question of publicity, the author would suggest that all accidents of a serious nature be investigated by a public hearing in which all interested parties could testify. Authority could be given the Secretary of Commerce to subpoena witnesses, but he would not be required to publicly fix the responsibility for any accident. The Department would be furthermore exempted from any civil liability resulting from the publishing of accident testimony.[50] The aeronautical interests do not demand an ostrich-like policy of secrecy when an accident occurs. They are entitled to full candor and freedom from exaggerated press stories. If the press was assured that every serious accident would be carefully investigated and the finding published it might be less prone to invent sensational causes of accidents for the consumption of their subscribers.[51]

The policy of secrecy has also been adhered to by the Aeronautics Branch in reference to the publishing of the names of the pilots and companies guilty of violating the regulations. This policy was probably justified during the first year of regulation because of the general unfamiliarity with the numerous regulatory provisions, and because of the effect such publication might have on a pilot's opportunity for employment. The regulations have now been in force for over three years and ignorance of the regulations would seem more serious than inten-

[49] Editorial, *Aviation*, December 7, 1929, p. 1098.

[50] These suggestions would require legislation amending the Air Commerce Act of 1926.

[51] For other comments see *Aviation*, editorials, August 17, 1929, p. 327; September 14, 1929, p. 555.

tional violation. Publication of the names of the violators should produce two worthwhile results:

1. The public could easily identify pilots and operators who were habitually violating the regulations.

2. The disciplinary effect of publicity should produce more careful pilotage and operation.[52]

Summary

In summarizing the suggestions contained in this chapter, it would be advisable to differentiate between the major changes recommended in administration and enforcement and those suggestions involving the minutiae or detail of subordinate or temporary questions. As a basic conclusion, the variety, complexity and technical nature of the regulations described in this chapter will indicate the necessity for some impartial agency to determine and enforce a code of minimum safety standards and requirements.

Administrative reorganization of a major nature has been suggested in the following recommendations:

1. Better supervision of the medical examiners by the creation of coördinating agents through the appointment of District Flight Surgeons.

2. The transfer of all engine testing work from the Bureau of Standards to the Aeronautics Branch, and the creation of engine testing stations in various parts of the United States.[53]

3. The setting up of sub-offices of the Registration Section in each of the nine inspection districts to further simplify the licensing procedure.

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[52] For an editorial expressing a dissenting point of view, consult *Aviation*, December 7, 1929, p. 1097.

[53] Since the completion of this book the Aeronautics Branch has proposed the establishment of four engine-testing bases in various parts of the United States. See Air Commerce Bulletin, Vol. II, No. 7, p. 175.

Major changes necessitating legislative action have been suggested in respect to:

1. An amendment to the Air Commerce Act of 1926, authorizing the Secretary of Commerce to publish accident findings, subpoena witnesses, and relieve the Department of Commerce from any civil liability resulting from the publishing of accident testimony.

2. Legislation requiring the recordation of liens on all aircraft with the Department of Commerce.

Recommendations of a minor nature suggested in this chapter are included in the classifications below:

1. A higher salary scale for pilot inspectors, because of the hazardous nature of their employment and because of the possibility that it will promote a more stable organization.

2. An immediate increase in the inspector personnel of the Inspection Service, and appropriations for additional aircraft to facilitate their inspection duties.

3. An increase in the salaries and personnel of the Engineering inspectors to induce greater stability and efficiency in that organization.

4. The creation of a training school for engineering inspectors.

5. A more adequate engine testing equipment for the Bureau of Standards, including equipment for testing propellers.

6. Publication of the names of pilots and companies guilty of violating the air commerce regulations to secure a higher degree of compliance.

V

FUNCTIONAL OPERATION OF THE AIR REGULATION

Having examined in the previous chapter the methods employed in the granting of approved type certificates for aircraft, engines, and propellers, the functional operation in applying civil penalty assessments, the factory inspection of aircraft and the administrative process of making accident analyses, we shall now consider the operations involved, and the qualifications and minimum requirements exacted, in the licensing of pilots, mechanics and aircraft, and the standards required of an approved flying school. These will give us a further insight into the work, methods and administrative machinery utilized in the enforcement of the air regulations.

Licensing a Pilot

Safe pilotage implies exceptional mental and physical coördination. The extreme importance of licensing pilots is indicated by the accident causation findings for the January-June period of 1929.[1] This report attributed over 59 per cent of all accidents to errors on the part of the pilot, chiefly poor judgment and technique. If it were possible to incorporate into the regulations a type of pilot's qualifications that would effectively prevent erring pilots from receiving licenses, there would be eliminated at one stroke over one half of the causes of accidents. It will, probably, be impossible to approach

[1] Air Commerce Bulletin, Vol. I, No. 14, p. 13.

such a set of qualifications, and if it were possible, there would not be a sufficient number of such perfect pilots to satisfy the present needs. It is obvious that since there are more accidents caused by poor piloting than anything else, an intensive study of pilot's license standards should be the first step towards improvement. This truth has been recognized by the Regulations Division in its constant modification of license requirements for pilots.

Medical Examinations

All pilots securing licenses must meet the physical requirements of the Air Commerce Regulations. The relationship of physical condition of pilots and accidents has, unfortunately, not been studied intensively.[2] Some very meagre statistics of the Department of Commerce indicate that about 40 per cent of the accidents occurring during 1927 involved pilots who had not been examined, or who, having been examined, had been disqualified.[3] It is impossible, of course, to determine whether their physical condition had anything to do with their crashes, except in two cases where the reports showed that the pilots were physically unfit.

Transport pilots or passenger flying pilots are given a very thorough medical examination.[4] The prescribed physical qualifications include, good past history; sound pulmonary, cardio-vascular, gastrointestinal, central nervous, and genito-urinary systems; freedom from material structural defects or limitations; freedom from disease of the ductless glands; normal central, peripheral, and

[2] For U. S. Navy methods see G. C. Rhoades, Examination of Candidates for Aviation Training, U. S. Printing Office, 1928.

[3] *Domestic Air News,* No. 21, p. 9.

[4] For complete detail of Department of Commerce requirements, consult "Physical Standards for Airplane Pilots," U. S. Government Printing Office, 1928.

color vision; normal judgment of distance; only slight defects of ocular muscle balance; freedom from ocular disease, absence of diseased or obstructive conditions of the ear, nose, and throat; and no abnormalities of equilibrium that would interfere with flying. Limited commercial pilots, who are permitted to carry passengers for hire in designated areas, are required to have the same physical qualifications as the transport pilot. Industrial pilots, not permitted to carry passengers for hire, are allowed an eye acuity less than 20/30 if the applicant wears a correction to 20/20 in his goggles and has good judgment of distance without correction. The private pilot, not allowed to operate a plane for profit, is also permitted to use corrective goggles. All of these examinations are conducted by the Medical Section.

Good vision is probably the most important factor in safe flying. Unless a pilot is experienced and can secure a waiver, he must have normal vision to secure a transport license. Dr. L. H. Bauer states as the reason for this requirement, "The wearing of glasses under goggles is prohibited because it restricts the field of vision. In other words, the pilot can see straight ahead but has blurred vision at the sides. He is like a horse wearing blinders. It is possible that he may wear corrective lenses in his goggles. There are difficulties here, however. Many types of correction cannot be ground into a lens the shape of that used in goggles. If the eye defect is very great . . . a pilot whose goggles became smeared with oil or misted as he was about to make a landing and was compelled to take off his goggles as he was about to make a landing would have so little vision that he could not see the ground. Many pilots have been killed because they had poor vision."[5] Of almost equal importance to

[5] "Physical Tests and Their Relation to Flying," *Popular Aviation*, March, 1929, p. 19, by L. H. Bauer.

good vision is a good depth perception or the ability to judge distance to insure precision in landing and taking off. Muscle balance of the eye is another essential condition. Poor balance causes constant muscular effort to obtain single vision resulting progressively in marked fatigue, headache, inattention and finally carelessness. Further tests for the eye are given to determine the applicant's ability to focus his vision from far to near objects, necessary, for example, in shifting vision from the horizon to a map or instrument board. The size of the visual fields for form and color and color vision, itself, are determined by the medical examiner.

A normal sense of equilibrium is necessary because of the constant changing of one's plane of equilibrium from the horizontal plane necessitated in flying. A very simple test is now employed. It consists of standing on one foot, the other leg bent at the knee, eyes closed for fifteen seconds. The ability to perform this test indicates the absence of any serious defect of equilibrium. Poor equilibrium results in the flyer having difficulty in keeping his plane on an even keel and becoming easily confused by spirals, banks, and spins.

The medical examination is one of the first steps in securing a license. It has not been perfected to the point where it would indicate exactly what may be expected of any examined applicant when he attempts to fly. Dr. Bauer of the Medical Section states that the policy of his Section is not to deny that a disqualified applicant could not learn to fly or continue flying. "We do say that the hazards in his particular case are increased over and above a reasonable amount, and the Department cannot be responsible for vouching for him as a safe pilot. We look on trained pilots differently from students and waive many defects that would dis-

qualify students. This is because the most dangerous period—training—has been passed and their experience compensates to a certain extent for their physical disabilities."[6]

Classification of Pilots

The Air Commerce Regulations provide for four classes of licenses: Private, Industrial, Limited Commercial, and Transport with a further subdivision of the latter two classes. The minimum age requirements are sixteen years for private pilots and eighteen years for Industrial, Limited Commercial, and Transport. A Private pilot may be a citizen of any country, but the Industrial, Limited Commercial, and Transport pilots must be (1) a citizen of the United States; (2) a citizen of a foreign country which grants reciprocal commercial pilots privileges to citizens of the United States; or (3) an alien who has filed his declaration of intention to become a citizen of the United States.

Flying experience requirements are defined in the regulations, for Transport pilots, two hundred hours of solo flying, of which at least five hours must have been within the last preceding sixty days prior to the filing of the application. Limited Commercial pilots are required to have the same solo flying required of Industrial pilots. The Industrial pilot must have fifty hours of solo flying and the Private pilot ten hours of solo flying.

A revision of the regulations, effective as of September 1, 1929, makes a further subdivision of the Transport and Limited Commercial licenses. Previous to this amendment, it had been possible for a pilot holding a Transport or Limited Commercial license to operate any type of aircraft regardless of size. The analysis of

[6] Interview with Dr. L. H. Bauer, August 23, 1929.

accidents proved that a pilot may be capable of handling a single engine, two-ton ship, but, because of lack of experience may prove entirely incapable and dangerous at the controls of a multi-engine transport plane.

The regulations now provide that Transport and Limited Commercial pilots may pilot any type of licensed aircraft, but shall not carry persons or property for hire in licensed aircraft other than in those types specified in their licenses. They must demonstrate their ability to navigate licensed aircraft of one or more of the specified classes. The classes are as follows:

Class	Gross Weight in Pounds	Type
1	under 3500	single engine, open
1-A	under 3500	multi engine, open
1-B	under 3500	single engine, cabin
1-C	under 3500	multi engine, cabin
2	3500 to 7000	single engine, open
2-A	3500 to 7000	multi engine, open
2-B	3500 to 7000	single engine, cabin
2-C	3500 to 7000	multi engine, cabin
3	over 7000	single engine, open
3-A	over 7000	multi engine, open
3-B	over 7000	single engine, cabin
3-C	over 7000	multi engine, cabin

The Limited Commercial pilots have all of the privileges conferred and are subject to all the restrictions imposed upon Transport pilots, except that they are forbidden to instruct students for hire, or pilot aircraft carrying persons for hire outside of the areas mentioned in their licenses, except that they are allowed to function as a co-pilot on a dual controlled plane when accompanied by a Transport pilot who is in command of the ship.[7]

The Industrial pilot is permitted to operate any type of aircraft *not carrying persons for hire,* but is forbidden to instruct students for hire.

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[7] Section 47-b, Air Commerce Regulations, effective as amended, January 1, 1931.

The Private pilot may operate licensed aircraft, but is not permitted to carry persons or property for hire in licensed or unlicensed ships, or to instruct students in the operation of aircraft in flight.

A fifth class of pilot has been designated in the Air Commerce Regulations as the Glider pilot. This type may pilot any kind of motorless aircraft, but shall not transport persons or property, or instruct students except in licensed motorless aircraft.

Examinations and Tests

A pilot applicant having successfully passed his physical examination and filed his application under oath as to his character, age, citizenship, and flying experience, is then required to pass definite practical and theoretical examinations and a practical flight test.

These tests are conducted by the Field Inspectors of the Inspection Service of the Air Regulations Division. The written and oral tests for the Transport pilot consist of an examination on the air traffic rules, those portions of the Air Commerce Regulations pertaining to the pilot's privileges and limitations and to the inspection and operation of aircraft, further examinations on elementary engine and plane mechanics and rigging, and a theoretical examination in the fundamentals of meteorology and air navigation.

A practical flight test of the applicant is required to determine his ability to operate aircraft. For the Transport pilot, these maneuvers include: normal take-offs and landings; a normal landing from an altitude of 1500 feet, with engine throttled, and make a 360° turn in the descent touching the ground within 200 feet in front of a mark designated by the examiner; a similar landing from 1000 feet altitude making a 180° turn; a series of

five gentle and three steep figure eight turns, from 800 to 1000 feet respectively; a spiral in one direction from an altitude of 2000 feet, with engine throttled, making a normal landing within 200 feet of a mark designated by the examiner; emergency maneuvers, such as spins, spirals, side slips, climbing turns and recovery from stalls; a flight over a triangular or rectangular course of at least 100 miles landing at place of take-off within five hours, including two obligatory landings not at the point of departure; and finally, cross-wind landings and take-offs.

The Limited Commercial pilot is required to pass the same examinations and tests of the Transport pilot, except the cross-country flight and the examinations on elementary meteorology and navigation. The Industrial pilot's examinations are similar to the Limited Commercial pilots, except that he is required to negotiate a satisfactory sixty-mile cross country flight.

The Private pilot is required to pass an examination on the air traffic rules and portions of the Air Commerce Regulations pertaining to pilot's privileges and limitations and to the inspection and operation of aircraft. The practical flight test consists of maneuvers involving five gentle and three steep figure eight turns from 800 to 1000 feet, and landing with engine throttled within 500 feet in front of a mark designated by the examiner from an altitude of 3000 feet.

Most of the Field Inspectors are operating on a fixed itinerary. Applicants for pilot's licenses present themselves at the various points on the inspector's itinerary for examinations and flight testing. Upon satisfactory completion of the examinations and tests, the Field Inspectors communicate to the Licensing Section the names of applicants who have successfully qualified for the various pilot classifications.

Licensing Mechanics

To further guarantee safety, the Air Commerce Act of 1926 made provision for the examination and rating of all persons who are in charge of inspection, overhauling, or repairing of aircraft.[8] The Air Commerce Regulations provide that all workmen or mechanics in charge of repair or overhaul of engines or aircraft must be licensed by the Department of Commerce.[9] Mechanics are classified as engine or airplane mechanics. A person may hold a plurality of licenses.

An applicant for an engine mechanic's license must have had at least two year's experience on internal combustion engines; one year of which must have been on maintenance of aircraft engines, and is required to show his ability to read, write, speak, and understand the English language. An applicant for an airplane mechanic's license must have had at least one year of actual experience in building or repairing aircraft.[10]

Both types of license are granted upon the satisfactory passing of examinations given by the Field Inspectors of the Air Regulations Division. The examination for the engine mechanic's license consists of a test of familiarity with the Air Commerce Regulations relative to the operation and inspection of aircraft. The applicant is further required to show sufficient knowledge of engines and their accessories, including ignition systems, to be able to inspect, maintain, and overhaul them properly.

The airplane mechanic's license is granted after the successful passing of tests which determine the applicant's knowledge of plane structure and rigging, including control systems, as well as those portions of the Air

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[8] Section 9-k.
[9] Section 64 of the Air Commerce Regulations.
[10] See Chapter 6 of Air Commerce Regulations.

Commerce Regulations which pertain to the operation and inspection of aircraft.

The place of the mechanic in safe operation of aircraft is a most important one. Experienced supervision of inspection and repair of aircraft and engines is one of the major secrets of successful operation. The Airplane Mechanics Association have seriously objected to Section 64 of the Air Commerce Regulations, which permits unlicensed mechanics to repair and overhaul licensed aircraft if they are in charge of a licensed mechanic. The Association states that much work being done by unskilled mechanics is being approved by licensed mechanics and especially by pilots holding mechanic's licenses, without their having been present while the work was in progress. The Association suggests as a remedy that the Commerce Department issue mechanic's apprentice licenses. In reviewing this suggestion, an editorial points out that, "Raising the standards of mechanics is highly desirable but can best be accomplished through private means rather than a governmental agency. The Mechanics Association, itself, should prove a powerful means of raising standards and improving present conditions. If the Association selects its members with care and disciplines those who prove unworthy, membership in it would mean more than any card given out by the Government."[11]

Licensing Aircraft

All planes being operated in interstate or foreign air commerce carrying persons or property for hire, in furtherance of a business, or navigated from one state to another in the conduct of a business, must be licensed by the Federal Government. Planes operated commercially intrastate or for pleasure interstate, may be licensed

[11] *Aviation,* June 29, 1929, p. 2261.

upon the request of the owner.[12] All planes not licensed must be identified.

Licensed planes are required to display the license number preceded by various Roman capital letters assigned by the Commerce Department and designating the type of license granted. The letter S (meaning State) is assigned to all aircraft used solely for governmental purposes and belonging to States, Territories, Possessions, or political subdivisions of these units. The letter C is used on commercially operated craft which are permitted to carry persons or property for hire. The letter R (restricted) is issued to all planes, not eligible for commercial passenger carrying license, but which are found to be airworthy for specifically designated purposes such as racing, crop dusting, or aerial photography. Planes licensed for experimental work only and not permitted to operate commercially or carry persons or property for hire are designated by the letter X (experimental). In addition to the C and R symbol, the international symbol N will be used on all planes licensed in the above classes. All planes licensed after September 1, 1929, will be designated as NC or NR followed by the license number. Aircraft identified but not licensed bear the identification number only which is not preceded by any letter. The Regulations provide for the exact location and size of license numbers and identification marks.[13]

In general, there are two classes of airplanes which are eligible for license. First, types of planes itemized under the Engineering lists which are manufactured under Approved Type Certificate. These ships are licensed at the factory. License numbers are assigned

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[12] Air Commerce Act, Sections 1, 3-a, and 11; see also Chapter 3 supra.

[13] Section 41 of Air Commerce Regulations.

by the local factory inspector after a satisfactory flight test. Second, aircraft whose stress analyses have been checked by the Engineering Section, but have not been manufactured under an Approved Type Certificate, are nevertheless eligible for inspection and license at the factory. This group would include ships for which an Approved Type Certificate is about to be issued, or ships on which the Engineering Section has all the stress analyses data, but no certificate is wanted, due perhaps to no more ships of that type being built. These two classifications of aircraft, both eligible for license at the factory, constitute one of the main groups of licensed ships.

A second principal group of aircraft eligible for license are those ships manufactured prior to October 1, 1927. This group consists of numerous war surplus aircraft and a few airplanes manufactured in the period from the close of the war to October 1, 1927. Provision is made for the licensing of this type of aircraft if they are of "proper design, assembly, and workmanship, and of suitable materials and equipped in accordance with these regulations."[14] All planes in this group are subjected to a flight test to determine their airworthiness.

In the future, the majority of aircraft will be licensed under an Approved Type Certificate. A typical licensing process for such aircraft will involve: first, approval for Approved Type Certificate of the aircraft, the engine, and the propeller by the Engineering Section; second, a successful flight test conducted by the Engineering inspectors; third, the checking of production by the Factory Inspectors for workmanship and materials; fourth, final flight test and check of product for conformance to the Approved Type Certificate specifications; fifth, the clerical process of registering and recording the aircraft

[14] Section 14-b. Air Commerce Regulations.

in the Registration Section as a licensed aircraft of the United States.

It is reasonable to assume that if these various steps are performed conscientiously, the Commerce Department will have accomplished much in guaranteeing the airworthiness of licensed aircraft. The present regulative provisions cover every phase of aircraft production from design approval to the flight testing of the finished product.

After an aircraft is licensed, the owner is charged with the continuous duty of maintaining the aircraft in good repair and flying condition. For the violation of this duty the license of the aircraft may be suspended or revoked. All licensed aircraft must be given a line inspection at least once within each twenty-four hours preceding a flight. The scope of this line inspection is defined in the Air Commerce Regulations.[15] After each 100 hours of flight, the aircraft must be given a "periodic examination" by a licensed mechanic.[16]

One other factor must be dealt with in building up a regulative system which implies that a licensed aircraft is an airworthy aircraft. Major and minor repairs to licensed aircraft must be made with a degree of workmanship that will insure fixed and continuous airworthiness. The regulations require that minor damages must be fully repaired and approved by a licensed mechanic before the plane may be flown with passengers for hire.[17] A plane damaged to a greater extent than fifty per cent is classified as a major repair. Damage to a lesser extent than fifty per cent may be classified as a major repair by the Field Inspector. In making a major repair the rebuilder is required to submit to the Commerce Depart-

[15] See Section 27.
[16] *Ibid.*
[17] Section 30, Air Commerce Regulations.

ment drawings and stress analysis of the parts to be repaired or rebuilt. If these plans are approved by the Department, the rebuilder may proceed with the repair work. The completed repair is inspected by the Field Inspector, after he has received a statement under oath from the rebuilder that all work has been done in accordance with the drawings and stress analysis approved by the Department.[18]

It will be noted from this regulative description that the principle of continued supervision is observed on all aircraft licensed by the Department of Commerce. The Department approves the design of aircraft, engines and propellers; checks the construction for workmanship and materials; flight tests the finished product; requires daily and periodic inspections by the owner and licensed mechanics; and, finally, requires approval of the methods and materials to be used in the repair of a damaged licensed plane as well as a complete report of the accident that caused the damage.

The effectiveness of most of this regulation, after the plane is in possession of the owner as a licensed ship, depends upon the coöperation of the owner or operator of the aircraft. The owner is required to report accidents and to submit a semi-annual log of his plane showing hours flown, repairs and replacements. The failure to report accidents is a frequent occurrence.

Rating of Flying Schools

Under an amendment[19] to the Air Commerce Act of 1926, passed on February 28, 1929, the Secretary of Commerce was authorized to rate civilian schools giving instruction in flying. Collective attention was first

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[18] Chapter 3, Air Commerce Regulations.
[19] Public No. 846—70th Congress, S. 5350.

directed to the problems of flight instruction and the flying school at the conference of the industry with the Aeronautics Branch held in Washington in December of 1927. This conference decided to allow the flying schools to solve their own problems during 1928. The Aeronautical Chamber of Commerce reopened the question by the appointment of a Flying School Committee which rendered its first report at the Flying School Conference held at Chicago on December 4, 1928.[20] The committee emphasized the fact that flying schools were for the most part operating entirely within the boundaries of one state and did not fall within the control of the Federal Air Commerce Act. It suggested that the Chamber of Commerce could assist the situation by requiring that schools would measure up to minimum requirements before being recognized as members of the Chamber. In the meantime, special legislation introduced by Senator Bingham was passed and enlarged the Commerce Department's powers in that field.

The Bingham amendment provides for the examination and rating of flying schools to be made only "upon the request of the owners or representatives of the air navigation facilities or schools." This followed the practice used in airport rating.

The approval and rating of flying schools as provided for in the Bingham amendment will be a most important factor in the elimination of haphazard individual instruction and the promotion of highly organized institutions of flying training. Colonel Charles A. Lindbergh comments on the school problem, "A great many serious aviation accidents occur because of pilots who are turned out of cheap schools, without sufficient experience to meet emergencies."[21]

[20] A full report of the Committee will be found in *Aero Digest,* January, 1929, p. 122.

[21] *Domestic Air News,* No. 32, p. 5.

The intent and purpose of flying school rating is to protect the public and at the same time to assure adequate instruction to the pilots of the very near future who will be transporting a rapidly increasing tonnage of mail, express and passengers. More competent and efficient pilotage will strengthen the entire fabric of air transport.

The records of the Accident Board indicate that by far the greatest number of accident causes are chargeable to personnel and that the greatest contributing factor in that category is poor technique. The natural conclusion is a reflection upon the pilot's original training, indicative of a necessity for higher standards in flying schools. To carry out the purpose of the Bingham amendment, the Department of Commerce has promulgated a number of new regulations embodied in Aeronautics Bulletin No. 7-B, which is known as the School Supplement.

Flying schools are rated and approved only upon the request of the owners or representatives of the owners. The acceptance of regulation is therefore entirely voluntary. The first group of schools to be officially approved by the Department of Commerce were issued approved school certificates on July 15, 1929. These schools widely advertised the fact that they had been approved by the Department of Commerce. The *Aero Digest,* a trade journel, announced that it would be their policy to refuse to accept advertising from any school that had not at least made application for a Department of Commerce rating. It is obvious that in the future an approval of school facilities by the Department of Commerce will be highly advantageous to the school operator if not obligatory.

To secure an approved school certificate, the owner or representative must file, under oath, an application with the Secretary of Commerce. Upon the receipt of

this application the School Inspectors of the Air Regulations Division inspect the school and determine whether its equipment is suitable and airworthy, whether its instructors are competent, and whether its course of instruction is adequate.

Suitable and airworthy equipment means: First, that all airplanes used for instruction must be licensed for that purpose by the Department of Commerce. Second, that the total number of planes engaged in actual instruction from a given field shall not exceed 10 planes per 100 acres. Third, that not more than 15 students be enrolled in flying courses for each airplane available for flying instruction purposes. Provision is also made for minimum size fields, hangar and shop facilities for the proper maintenance of the schools instruction planes.[22]

Approved flying schools must employ instructors who have received flying instructor's rating from the Department of Commerce. This rating is issued only to transport pilots who have passed the prescribed tests, including a flight demonstration of ability and practical and theoretical examinations in the explanation of flight maneuvers. To maintain the efficiency of the instructors, the regulations provide that no instructor shall exceed six hours of dual instruction per day, or give instruction more than six days per week. On this provision, the Commerce Department made the statement, "Undoubtedly, six hours of dual instruction in a day, if continued for a long period, would result in a decrease of efficiency on the part of the instructor. However, on account of the possibility of interfering factors, such as weather, the six hour limit was made to take these factors into consideration, with the further provision that the

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[22] Air Commerce Bulletin, No. 6, p. 3; Section 5-A, School Supplement. Aeronautics Bulletin No. 7-B.

school is responsible that the instructors efficiency is not impaired by continued daily instruction at or near the maximum daily allowable time."[23] Provision is also made for the rating of all ground instructors who instruct in one or more ground school subjects.

The military schools have provided, until recently, the largest source of trained pilots. The efficiency and adequacy of these schools are unquestioned. The demand for pilots has exceeded this source of supply. Future demands for pilots must be met by the commercial schools, and many of these schools have been sadly inadequate in the past as to both quantity and quality of their flying instruction. A second serious difficulty was the distressing lack of uniformity in the training given by the various commercial schools.

To provide adequate civil flying instruction, the Department of Commerce requires every approved flying school to maintain a standard of ground and flying instruction that will assure that nine out of every ten graduates who apply for a license will be able to satisfactorily pass the department's tests for private, limited commercial, or transport pilot's license.[24]

The minimum curriculum requirements under the school regulations stipulate that an applicant for a private pilot's license must receive ten hours of dual instruction and eight hours of solo flying. The applicants for Limited Commercial licenses are permitted to apply not less than fifteen and not more than twenty-five hours of dual instruction toward their fifty hours solo time required by this type of license. For the Transport license, thirty-five hours and not more than fifty hours of dual time are required out of the necessary two hundred

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[23] Air Commerce Bulletin, No. 6, p. 3; Section 5-A, School Supplement.

[24] Aeronautics Bulletin 7-B, Section 6-D.

hours. This provision permitting dual time to be counted as solo time has the advantage of allowing the student to receive dual instruction after he has made his first solo flight. It is a well-known fact that students flying without an instructor develop many faults in technique which would be rectified by additional dual time.[25]

Provision is made for actual instruction on different types of aircraft. Approved schools are required to give applicants for the Limited Commercial license at least two hours training in flying each of two distinct types of planes other than those used for primary dual instruction. An applicant for the Transport license receives the same instruction, but for a period of at least ten hours on each type of ship. In both license classifications one of the ships flown must be a closed cabin plane. The Transport license applicant must also receive a minimum of ten hours solo training in night flying.

The ground school requirements of the Department prescribe that adequate instruction be given in Air Commerce Regulations; in aviation engines, including principles of internal combustion, carburetion, ignition, lubrication, cooling, construction, maintenance and repair; airplanes, including the history of aviation, theory of flight, nomenclature, aerodynamics, construction, rigging, inspection, maintenance and repairs; meteorology; aerial navigation; aircraft instruments, including radio and its use in aeronautics; and the care and use of parachutes. The number of subjects and the required time to be devoted to each varies with the rating, the transport ground course being the fullest and the most complete.

Flying School Inspectors

Inspection of schools was begun on June 1, 1929. Five of the Field Inspectors were designated as School

[25] Interview with Mr. G. S. Marriot, Chief of School Inspectors.

Inspectors. More inspectors have been added as the expansion of the work made it necessary. These inspectors in the field determine the suitability and the airworthiness of the equipment. They report what provisions the school has made for maintenance and repair of its aircraft. They also report on hangar facilities, the number of licensed mechanics employed, the size of the field and safety of the terrain for instruction purposes, the night flying equipment, and the number of parachutes owned by the school. The entire physical plant is minutely inspected from the point of view of safety promotion. The school inspectors flight test every instructor and make full reports to the Commerce Department. Ground instructors are not only required to pass written examinations, but also to demonstrate their ability to impart their knowledge to a class of students.

One Section[26] of the school regulations appears to be rather arbitrary. This Section states that, "A school which has been disapproved for an approved school certificate may reapply for such rating at any time after the expiration of ninety days of such disapproval." The necessity of receiving an approved rating to attract prospective students makes it imperative for a school to obtain approval as soon as possible. The disapproved school is required to tie up its investment for three months. It would seem more equitable to approve a school as soon as it has met the Commerce Department's requirements.

Summary

The author has indicated in this chapter the functional operation of the Air Regulations Division and the specific character of some of the more representative types of regulatory provisions. Three years of enforce-

[26] Section 3-D.

ment of the regulations has been productive of many revisions, while such revisions may continue indefinitely, future changes will be more of a minor character than those of the past three years. The present requirements seem to be apace with the industry. Additional experience and more emphasis and time devoted to an intensive study of the requirements will result in regulations that will assure even a greater degree of safety. The scope of the regulations is several strides ahead of an adequate enforcement personnel. Counterbalancing this defect is the admirable coöperation of the aeronautical industry and transport operators in voluntarily submitting to the regulative provisions and conscientiously carrying out the spirit of the Commerce Department's rulings.

VI

AERONAUTIC DEVELOPMENT SERVICE

In addition to the regulation of air commerce, it is the function of the Secretary of Commerce to foster and encourage the development of the aviation industry. The Air Commerce Act of 1926 provides that, "It shall be the duty of the Secretary of Commerce to foster air commerce in accordance with the provisions of this act, and for such purposes: (a) to encourage the establishment of airports, civil airways, and other navigation aids; (b) to make recommendations to the Secretary of Agriculture as to the necessary meteorological service; (c) to study the possibilities for the development of air commerce and the aeronautical industry and trade in the United States and to collect and disseminate information relative thereto and also as regards the existing state of the art."[1]

To perform these functions there has been created an Aeronautic Development Service embracing all of the activities of the Department of Commerce[2] in respect to:

1. The collection and dissemination of data on civil aeronautics.

2. The encouragement of airport construction and other aids to navigation.

3. Advising of communities in the selection and development of airports.

[1] Public No. 254, 69th Congress, Section 2.

[2] Another office, not a part of the Aeronautics Branch, designated as the Aeronautics Trade Division of the Bureau of Foreign and Domestic Commerce, may be noted because of its work in promoting the airplane export business. A summary of its functions is contained in an article in *United States Daily,* February 19, 1930, p. 8.

4. The rating of airports.

5. The promotion and correlation of aeronautic research.

6. The publication of air navigation maps and airway bulletins.

7. The general promotion work of the Department of Commerce, encouraging the development of civil aeronautics in the United States.

All of these activities are coördinated and supervised by the Director of the Aeronautic Development Service. The Service is divided into an Aeronautic Information Division, an Aeronautics Research Division, an Airport Section, an Airways Mapping Section, and special research committees.[3]

The Aeronautic Information Division

During the latter part of 1929, this Division was reorganized to increase its efficiency in performing its numerous functions. Four groups have been formed in this Division; all of them under the direct supervision of the Division chief. They are the Airway Bulletin Section, the Statistics and Distribution Section, the Editorial Section, and an Aeronautics Reference Library.[4]

The Airway Bulletin Section

This Section serves as the general clearing house for all data on intermediate fields, airways of the United States, meteorological conditions and airports. The service offered is steadily increasing in importance due to the rapid growth of flying other than on scheduled

[3] Examples of such committees are the "Fact Finding Committee on Automatic Sprinkler Protection for Airplane Hangars" and the "Committee on Standard Signal Systems for Airports." Both committees under the chairmanship of Colonel Harry H. Blee, director of Aeronautic Development.

[4] Air Commerce Bulletin, Vol. I, No. 13, p. 1.

flights over charted airways. The ultimate goal of the Airway Bulletin Section is to maintain current information on all air navigation facilities in the United States in readily available form for the use of the flying public.

During the fiscal year 1929, approximately 260 airway bulletins were issued, 29 revised and 289 reprinted. These bulletins were distributed to a mailing list of 3,400 individuals and organizations. A total of 663 airway bulletins had been published up to June 30, 1929, and 401 additional bulletins will be published before June 30, 1930.[5] As illustrative of the type of information supplied by these bulletins examine Airway Bulletin No. 69 which describes meteorological conditions in Pennsylvania in respect to cloudiness, fog density, heavy rain and snow, thunderstorms, prevailing surface-wind direction and force, etc. Airway Bulletin No. 9 lists all meteorological stations in the United States. Bulletin No. 512 warns pilots of kites and captive balloons that are flown periodically throughout the day by the meteorology stations at Broken Arrow, Oklahoma, Royal Center, Indiana, etc. Bulletin No. 24 advises pilots that there is now an aircraft filling station located on the flying field at Monticello, Arkansas, and that the Hagerstown, Maryland, field will be planted in corn this year and in wheat the next two years, and that Soldiers Field of Harvard University located at Cambridge, Massachusetts, is no longer available for landing. Other bulletins describe airways. No. 158 maps the Dallas-Kansas City airway with a description of all intermediate fields on the route and the identifying characteristics of all light beacons. Most of the bulletins are descriptive of particular airports. Bulletin No. 197, for example, describes the airport at Oakland, California. The usual

[5] Information obtained from Mr. John Groves, Chief, Airway Bulletin Section, interviewed, August 26, 1929.

type of airport bulletin contains two maps: one of the airport itself showing wind rose[6] and immediately surrounding terrain and the second map showing the location of the airport with respect to nearby railroads, rivers, and the nearest city. Other information contained in an airport bulletin indicate whether the airport is municipally or privately owned and give a brief description of the surfacing, landing strips and general shape, surrounding obstructions, the marking and identification, lighting, accommodations and the communication and signal equipment. All of the bulletins contain some meteorological data of a general nature relative to the prevailing wind, precipitation, occurrence of fog and the location of the nearest weather bureau or upper air station.[7]

The high degree of accuracy of the information contained in the Airway Bulletins is rather remarkable considering the methods employed in collecting this data. The greater part of the information is obtained from questionnaires filled out by the owners or managers of the various fields and airports.[8] This information is checked, if it is checked at all, by any possible method that might be available. The inspectors of the Regulations Divisions and the engineers of the Airways Division assist whenever possible. It would appear that information on our airports, landing fields and airways is of sufficient importance to warrant a better checking method.

In addition to the records of airports and intermediate fields, the Airway Bulletin Section maintains a record of over 6,000 other fields that may be used in

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[6] The wind rose is a symbol used to indicate relative wind frequencies and average velocities at an airport.

[7] This section also distributes maps prepared by the Hydrographic Office of the Navy Department and the Air Corps of the War Department.

[8] Form A. B.-4, Department of Commerce, Aeronautics Branch.

emergencies for landing purposes. These fields are not included in the Airway Bulletins because they are not used solely for aircraft operations. During the year 1929, airports were established at the rate of 75 a month and bulletins were completed at the rate of 40 per month. The failure to keep airport information abreast with airport construction may be attributed to the questionnaire method of collecting data.[9] To better an essential service contributing to aeronautic safety, it is suggested that the collection and checking of airport and airway information be assigned to the field inspectors of the Air Regulations Division. This would seem advisable because these inspectors are already familiar with their respective territories, and secondly such a disposition of this task would not necessitate the creation of another group of field men. Such a disposition would require an increase in the field personnel of the Air Regulations Division.

Sectional Area Maps to Replace Strip Maps

Until the year 1929, all of the maps compiled by the Aeronautics Branch and the Coast and Geodetic Survey were of the strip type, that is, they mapped an area of approximately 20 miles in width between two airports. Due to the rapid increase of flying on other than scheduled airways it is evident that no strip map program could ever hope to satisfy the demands of this type of miscellaneous flying. The multiplication of expense and effort involved in any such attempt is obvious. In accordance with the recommendations of the air navigation map committee of the Federal Board of Surveys and Maps, the Department of Commerce has begun a publication program of sectional area air navigation charts to cover

[9] Opinion of Mr. John Groves, Chief, Airway Bulletin Service Section, expressed to the author on August 26, 1929.

the entire United States. This plan provides for 92 divisions of the United States, each comprising 6° of longitude and 2° of latitude, on the same scale as the strip maps now in general use, 1:500,000.[10] It will cost approximately $7,500 to map each division. It is expected that, without increased personnel, the compilation of these sectional or general flying charts of the entire country will take about 15 years to complete.

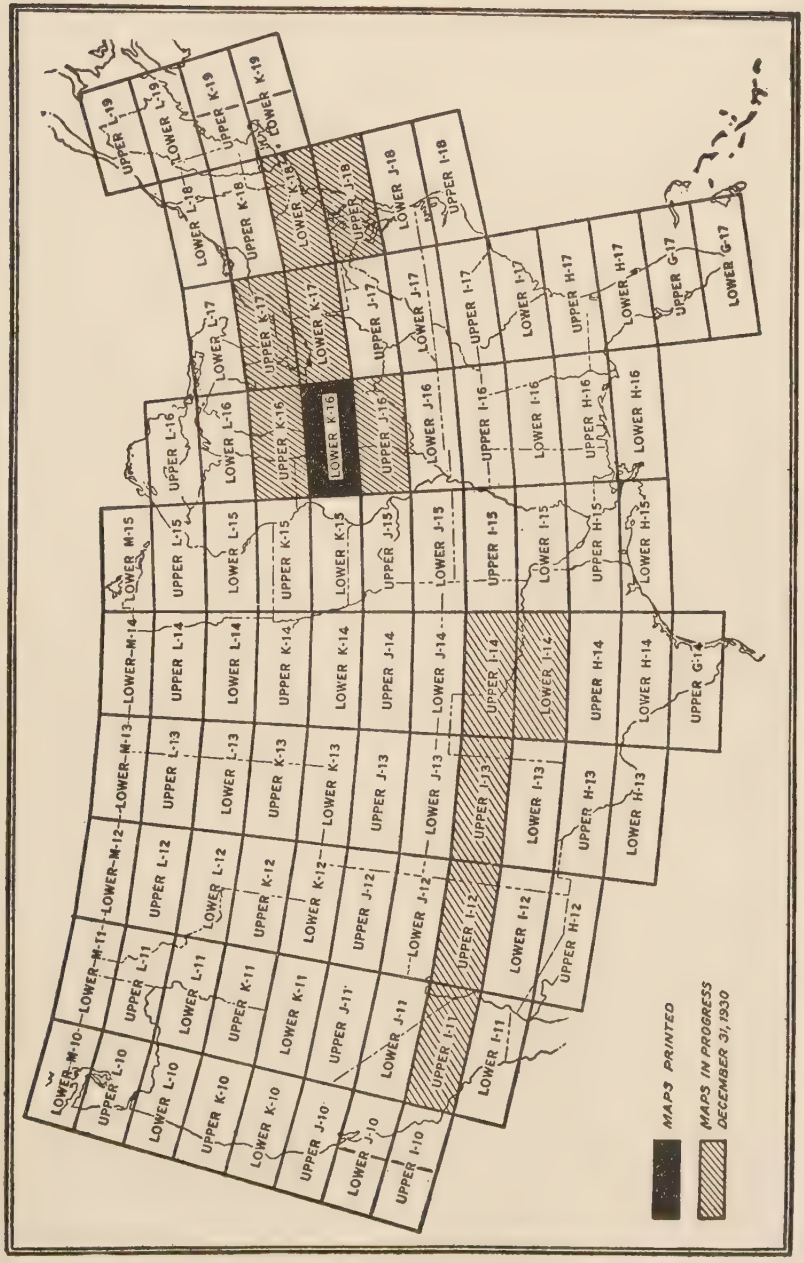
Statistics and Distribution Section

This Section of the Division of Aeronautic Information functions as the contact office between the Aeronautics Branch, the aeronautics industry, and the general public, either by personal interviews, correspondence, or through the distribution of publications. It also serves as the agency for the procurement, compilation, and analysis of all statistical data for the Aeronautics Branch. This data includes statistics and information on aircraft production, aircraft accidents, aircraft operation, and aids to air navigation. It prepares for publication all of the statistical bulletins of the Aeronautics Branch as well as the Aeronautics Trade Directory.[11] This Section keeps in close contact with other agencies of the Federal Government identified with aeronautics and coördinates such information for issuance.

The volume of correspondence of the Statistics and Distribution Section has rapidly increased during 1928-29. In the period from April to June, 1929, the Section replied to 700 inquiries per month by letter and answered

[10] Report of Federal Board of Surveys and Maps, Air Commerce Bulletin, Vol. I, No. 4, p. 21; Domestic Air News, No. 44, p. 4. For index to Aeronautical charts, see Map B. The methodology of preparing sectional area maps is discussed in Air Commerce Bulletin, Vol. II, No. 14, p. 357.

[11] Aeronautics Bulletin No. 3. For list of other publications of the Aeronautics Branch, see Annual Report of the Director of Aeronautics, 1930, p. 33.



MAP B
Sectional Area Maps

3,200 inquiries per month by the forwarding of one or more Bulletins or application forms. An average of 23,500 Bulletins and 13,500 applications were distributed each month.[12] The mailing list of the Section contains more than 12,000 names. Without specific request, new and revised Bulletins and the semi-monthly publication, *Air Commerce Bulletin,* are sent to this mailing list. In addition to the chief and the assistant chief of the Section, seven clerks handled all of this work during the fiscal year 1928-29.

The Section is developing intelligence files of all the data collected from the industry and other sources so that much time will be saved in the future in answering inquiries. These files will serve as invaluable aids and records of a permanent nature to assist future research on the trend of the aeronautic industry. Statistics on the census of aircraft, engines, and propeller manufacture, tables on airway operations, miscellaneous flying, gas and oil consumption by the various classes of operators, quarterly statistical statements on the status of aircraft, pilots, and mechanics licensed by states, and other information of value is being compiled for the use of the public and the Editorial Section of the Aeronautic Information Division.

Accident Classification[13]

The classification and arrangement of civil aircraft accidents and casualties for statistical purposes is handled by the Statistics and Distribution Section. This work requires the continuous attention of one man in the Sec-

[12] Statement of Mr. E. R. Strong, Chief, Statistics and Distribution Section, interviewed by author, August 26, 1929.

[13] This classification work was formerly a function of the Air Regulations Division. It still serves as the analysis agency for individual accidents but the statistical compilation is now one of the duties of the Statistics and Distribution Service.

tion. This man must be thoroughly acquainted with the method of analysis employed by the inspectors of the Air Regulations Division and the Accident Board in order to properly classify and analyze each accident.[14] The resulting statistics of this type of classification of accidents are of tremendous value to Finance and Insurance Companies, Actuary Societies, and the Press Service. Insurance companies are not satisfied with the present statistics and feel very hesitant about insuring aviation risks. On this point, Mr. W. C. Pond of the John Hancock Mutual Life Insurance Company said, "There are not enough statistics for life insurance companies to establish a definite premium. . . . The only thing that we find difficult is to get the information which will enable us to safely authorize or issue life insurance to those who are interested in the planes." [15] It would seem that there is much work to be done in giving the insurance companies more adequate and usable information on accident statistics. Accident probabilities can be determined with a fair degree of accuracy in scheduled flying. It is in miscellaneous or itinerant flying that the risk hazard must be more carefully computed and ascertained by better statistical methods. Mr. E. R. Strong, chief of the Statistics and Distribution Section, recognizes this defect and admitted that better statistics should be made immediately available.[16]

Editorial Section

The principal task assigned to the Editorial Section is the publication of the semi-monthly Bulletin of the Aeronautics Branch called the *Air Commerce Bulletin.*

[14] For a discussion of the method of analysis employed see Report of the First National Safety Conference, p. 756.

[15] Report of the First National Safety Conference, p. 712. This same thought has been reiterated by Dr. S. Sweeney of the University of Pennsylvania.

[16] Interview with Mr. E. R. Strong, August 26, 1929.

This Bulletin was formerly issued, in mimeographed form, as the *Domestic Air News*. The present *Air Commerce Bulletin* is printed. It is distributed to over 12,000 readers who have specifically requested it. It is also circulated through libraries, airports, and aeronautical clubs. The scope of the Bulletin is described by Mr. R. S. Clary, chief of the Section, as a publication which carries "official notices to pilots, operators, and manufacturers of aircraft; notices of suspension and revocation of licenses and registrations, lists of reserve airspaces set aside by the President; statistics on operation, miles flown, accidents and their causes, gross income and operating expenses of airlines; lists of aeronautical lights certified, general notes on the progress of civil aeronautics at home and abroad; lists of air routes in operation; notes on the progress of airway lighting, radio, and other aids to air navigation; lists of Department of Commerce medical examiners; articles and tabulations on airport and airway development; State laws and municipal ordinances; sample contracts; proposed airports; lists of official publications available; and other constructive information of an authentic and authoritative nature relating to civil and commercial aeronautics."

The Editorial Section also serves as the official "spokesman" of the Aeronautics Branch. It issues weekly press releases to the newspapers containing information of a current nature which may be of interest to the general public and serves generally as an editing agency of most of the written material emanating from the personnel of the Aeronautics Branch.[17]

The Aeronautics Reference Library

In line with the idea of a complete information

[17] Interview with Mr. R. S. Clary, Chief of the Editorial Section, August 27, 1929.

service, there has been built up in the Aeronautics Branch the finest commercial aeronautic library in the United States. This library now contains approximately 450 bound volumes and more than 10,000 domestic and foreign magazine articles, pamphlets, and reports. Close contact is maintained with the aviation industry and with the other units of the Federal Government in the collection of data on the latest engineering developments. Complete files are maintained for all the publications of the Aeronautics Branch as well as the governmental publications of the National Advisory Committee for Aeronautics. In an editorial commenting on the importance of the Department's library, Mr. Robert S. Clary of the Aeronautics Branch said, "Some idea of the widespread public interest in aeronautics may be had from the fact that there are about twenty aeronautical trade journals in the United States alone which are devoted to aeronautical news and developments. There are fourteen such journals in France, ten in Germany, five in Great Britain, eight in Italy, and one or more in virtually every civilized country in the World." [18]

The Airport Section[19]

This Section, as now organized, is under the direct supervision of the Director of the Aeronautic Development Service. It has taken over most of the work relating to airport development which had previously been scattered among the various units of the now defunct Air Information Division.[20] The Airport Section was created on February 4, 1929. It functions with a per-

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[18] *United States Daily,* December 4, 1929, p. 16.

[19] Formerly called the Field Service Section.

[20] Other duties of the Air Information Division have been assumed by the recently formed Aeronautic Information Division.

sonnel of five airport specialists, including the chief of the Section.

The principal duty of the airport specialists is to assist municipalities and others interested in airport development in the selection of sites, and to offer advice concerning the proper methods of construction. Specialists are only sent out by the Section upon the specific request of the local authorities. To further facilitate work and economize the time of the personnel, the airport specialists have been assigned to cover planned itineraries.

Many times the Airport Section representatives are requested by a municipality or a local Chamber of Commerce to speak before a meeting in an effort to create a favorable attitude toward airport establishment. Most of the requests come from communities that have decided to establish an airport and desire specific advice in respect to their local problems. The usual function of the specialist is to examine ten or twelve possible sites, confer with local officials interested in the development of the airport, and perhaps give an address before some civic organization. Upon full completion of a local investigation, the airport specialist renders a full report to Washington. His report is thoroughly studied and reviewed and all recommendations are sent directly from Washington to the local interested party or parties. The Airport Section will not undertake to make a detailed engineering survey of airport sites. The principal reasons advanced for this policy are, first, lack of personnel, and second, that these services are already obtainable from well organized airport engineering companies.[21]

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[21] Interview with Mr. G. E. Sommers, Airport Specialist, Department of Commerce, August 26, 1929. For a list of Airport Engineering Companies, see Air Commerce Bulletin, Vol. I, No. 10, p. 8.

Federal Policies in Airport Promotion Work

In performing these advisory functions, the Department of Commerce airport specialists have advocated certain principles that may well be considered as a part of the Department's airport policy.[22] It has always urged public ownership of airports rather than private ownership. It has always supported the idea that every community should have at least one airport, centrally located. On the question of ownership, Mr. MacCracken has pointed out, that the "objection to private ownership of airports is that there is always the possibility that the land will become more valuable to the owners for some other purpose and that they might be persuaded to abandon it as an airport and turn it over to subdividers to sell. The private owner may perform a valuable service to aviation in making this land available for airport purposes, but the community should assure itself that, what will become an increasingly important facility, will not be withdrawn when the land increases in value." [23]

A second reason for public ownership is obvious. While private owners may guarantee equal treatment of all lessees and users, there remains the possibility of such arrangements not being carried out. Failure of a private owner to keep such an agreement might bring disaster to the aeronautical development of a community. Public ownership has been retarded because of the cost of construction and maintenance.[24] Newark, New Jer-

[22] In an address before the First Annual Airport Conference, Col. H. H. Blee concisely stated the general policies of the Aeronautics Branch in reference to airport promotion work; see *Air Transportation,* May 16, 1929, p. 8 et seq.

[23] *Aviation,* March 23, 1929, p. 879.

[24] Mr. J. D. Wood, Commissioner of Public Works for the State of Idaho has advocated the distribution of airport construction costs between the Federal, State and Local governments. Address before the All Western Airport Conference held in Los Angeles, November 7, 1929. Reported in *Aviation,* November 30, 1929, p. 1062.

sey, Cleveland and Buffalo have given a great deal of attention to the working out of plans that will place their respective airports on a paying basis. It is probable that no public airport is as yet actually meeting expenses, but the problem is being studied and it is reasonable to assume that publicly owned airports can be operated at a profit.[25]

An outstanding feature of the Commerce Department's airport promotion activity is its desire to foster as much uniformity as is possible. The Department has prepared publications dealing with the design and construction of airports, the management of airports, and the lighting of airports.[26] In an endeavor to secure uniformity in the field rules for airports, the Department has prepared a uniform city or county ordinance on that subject.[27]

The Federal Air Traffic Rules apply to all aircraft and airmen, whether engaged in interstate or intrastate flying. These rules are chiefly concerned with the operation of aircraft while in the air, with the exception of one Section that defines take-off and landing rules and the right of way of landing planes over planes taking off or moving on the ground.[28] In discussing the advisability of uniform field rules other than the above, the Commerce Department states: "There are a number of matters having to do with maneuvers on the ground and with flying in the immediate vicinity of airports which are not covered by the Air Traffic Rules and which should be

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[25] J. E. Bullard and A. E. Lord have made a study of this question and believe that profitable operation is possible, see "Making the Airport Pay for Itself," *Aviation*, November 9, 1929, p. 993 and November 23, 1929, p. 1023.

[26] See Department of Commerce pamphlets on "Designing Safe and Adequate Airports," "Construction of Airports," "Notes on Airport Lighting," and "Notes on Airport Management."

[27] Aeronautics Bulletin No. 20, Department of Commerce.

[28] Air Commerce Regulations, Section 75-a-c.

made the subject of local airport field rules. These rules should be required to be observed in the interest of both safety and the orderly, efficient and profitable operation of the airport. Also, from the standpoint of safety of operations, fields used commercially should be required to meet certain minimum requirements. . . . The general adoption of a standard code of field rules for the country at large will eliminate for air traffic much of the confusion evident in the automobile world today. According to an article by the Secretary of the National Conference on Street and Highway Safety, it is estimated that the losses 'attributable to unscientific and inadequate regulation of traffic' amount to twenty thousand persons killed, half a million injured, and a direct economic loss of two billions of dollars. The range of the airplane is even greater than that of the automobile and unless a standard code is adopted, the stranger flying across the country will be confronted with a bewildering variety of rules and requirements, differing at each airport visited." [29] The argument contains much truth and need not be further commented upon.[30]

Federal Rating of Airport Facilities

The Air Commerce Act of 1926 provides that the Secretary of Commerce shall by regulation "provide for the examination and rating of air navigation facilities available for the use of aircraft of the United States as to their suitability for such use." [31] In accordance with

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[29] Aeronautics Bulletin, No. 20, p. 5. See also *N. Y. Times,* July 28, 1929, p. 10.

[30] The All Western Airport Conference, held at Los Angeles, November 7, 1929, passed a resolution urging adoption of the "Uniform Rules for Airports" as contained in Department of Commerce Bulletin, No. 20. See *Aviation,* November 30, 1929, p. 1062.

[31] Public No. 254, 69th Congress, Section 3-d.

this provision of the law, rating regulations have been promulgated.[32] The administrative work involved has been assigned to the Airport Section of the Division of Aeronautic Information. It is in the exercise of this activity that the Commerce Department has been able to secure a high degree of standardization of airport facilities.

It has been the policy of the Department to rate airports only upon the application of the owner or authorized agent of the owner. The administrative procedure involves a formal application for rating by the owner directed to the Secretary of Commerce,[33] the review of the application at Washington by the Chief of the Airport Section, a visit by one of the airport specialists to check the information submitted in the application, and lastly the assignment of a rating by the Department of Commerce.[34] The rating certificate is issued for an indefinite time unless specifically revoked.[35] It is required, however, that annual reports be submitted covering the condition of the facilities and describing any material changes. Major changes shall not be made on rated airports without the approval of the Secretary of Commerce. The decision of the Secretary of Commerce, as to what constitutes a major change, shall be final. The regulations further provide that, "After an airport has been rated . . . it shall be so operated and maintained at all times as to meet at least the requirements of these regulations for the particular rating issued." [36]

Specific airport ratings are indicated by a letter, a

[32] Airport Rating Regulations, Aeronautics, Bulletin, No. 16.
[33] Form No. AB-2, Department of Commerce, Aeronautics Branch.
[34] Detailed procedure to be followed by an airport seeking Federal rating is contained in "Instructions to Applicants for Airport Ratings," Department of Commerce, Aeronautics Branch.
[35] Airport Rating Regulations, Aeronautics Bulletin, No. 16, Section 1.
[36] *Ibid.*

figure, and a letter. The first letter indicates the general equipment and facilities at the airport; the figure indicates the effective landing area; and the second letter indicates the night lighting equipment. An airport receiving the highest rating given would be designated as A 1 A. As representative of general equipment for an A (first letter) rating, an airport would be required to have at least one hangar of definite minimum size, a wind direction indicator of an approved type, repair equipment to permit changing of engines and landing gear and equipment for major engine and plane repair, weather instruments, including an anemometer, barometer, and thermometer, a radio receiving set, adequate equipment for removing snow, first aid equipment including an ambulance, a register of arriving and departing aircraft, adequate fire-fighting equipment, sufficient personnel in attendance throughout the day to give proper operation of the airport, including servicing aircraft, making major repairs, giving weather service, and operating the fire-fighting equipment, sleeping quarters for at least three men, in addition to the field personnel, waiting and rest rooms on the field, and a restaurant or other source of food supply not more than one-half mile distance from the airport.[37]

Rating on size of the effective landing area is designated by the figures 1, 2, 3, 4, 5, and 0. For the "1" rating an airport must have an effective landing area of 2,500 feet with clear approaches. A clear approach means absence of buildings or other obstructions over which a 7 to 1 glide or climb to or from the edge of the landing area would not be possible. The full 2,500 feet of landing area is required in all directions. For the "2" rating 2,000 feet of effective landing area in all direc-

[37] For requirements of airports for B, C, and D ratings see Aeronautics Bulletin No. 16, Section 5.

tions is required, for the "3" rating 1,600 feet of effective landing area in all directions, for the "4" rating 1,320 feet of effective landing area, for the "5" rating the airport must be used for a purpose which the Secretary of Commerce considers safe although the landing area is less than 1,320 feet. The "0" rating designates an airport which the Secretary of Commerce considers unsafe for operation, but from which operations are nevertheless taking place, and which requests a rating.

For an A rating (second letter) for night lighting equipment, an airport must have an airport beacon of not less than 100,000 candlepower, an illuminated wind direction indicator, boundary lights outlining the usable portion of the field not more than 300 feet apart with red boundary lights where the approach is particularly hazardous, red lights placed on all obstructions on and in the vicinity of the airport, hangar flood lights and roof marking, a ceiling projector, a landing area flood light system. All of this lighting equipment with the exception of the landing area flood light must be kept burning from sunrise to sunset. Sufficient personnel must be in attendance throughout the night for the proper operation of all lighting equipment.[38]

In addition to these, special requirements for general equipment, size of field and night lighting rating, the Commerce Department has defined certain minimum basic requirements which all airports must comply with to receive any rating. These basic requirements concerning suitable landing areas, freedom from obstructions, accessibility on a good road to the nearest city or town, definite prescribed markings, adequate drainage facilities, runways constructed of some wear resisting material, and fuel, communication and transportation facilities.

[38] For minimum requirements for B, C, D, E, and X ratings, see Aeronautics Bulletin, No. 16, p. 17 et seq.

There has been no attempt to go into any great detail concerning these rating requirements. The above exposition is intended only to indicate the general nature of the Department of Commerce rating requirements for airports.[39] The effect of this rating system in securing uniformity among airports located all over the United States, some privately owned, some publicly owned, has been of far reaching importance. While the Department of Commerce has only rated airports upon the request of the owners, it has been the experience of the Aeronautics Branch that most owners desire a Federal rating. The Director of the Aeronautics Branch reports: "This work is rapidly assuming increasing importance and application forms have already been requested by a number of cities. As yet, however, the applications are coming in slowly, due, no doubt, to the fact, that airport officials are discovering that additional conditioning or construction work must be done before the rating they desire can be obtained." [40] The Airport Section reports that all airports are tending to construct their fields in conformity with the Federal rating requirements, because they desire to be as far advanced as possible toward the A 1 A standards when they do request rating.[41]

It would seem advisable to speed the rating of airports. The principal purpose of rating is to afford a service to the aviation industry. Primary consideration should therefore be given to the making available of information as to the relative merits of the various airports. Even though such ratings might have to be tentative, due to incomplete information. It has been stated that airports are rated only at their own request. It

[39] For full details consult Airport Rating Regulations, Aeronautics Bulletin No. 16, Department of Commerce, Aeronautics Branch.

[40] Annual Report of the Director of Aeronautics for 1929, p. 37.

[41] Interview with Mr. A. P. Taliaferro, Chief, Airport Section, August, 27, 1929.

might prove highly advantageous to empower the airport specialists of the Department of Commerce to grade the various airports whether they ask for it or not. Compulsory rating would open up the question of just how far the government's jurisdiction extends over the local airports.[42] It might be conceded that the Federal power over local airports is rather limited. It may, however, be possible to exercise some indirect power. It seems likely that the Federal Government could exercise some degree of control over airports that are used by interstate aircraft and by this means make some kind of a rating of all airports except those that are exclusively restricted to the use of intrastate air traffic.

The Aeronautics Research Division[43]

This Division has been organized in the Bureau of Standards to carry on the aeronautic research work of the Aeronautic Development Service. The Division has been subdivided into a Radio Section, Lighting Section, Aricraft Engine Section, Wind Tunnel Section and an Engineering Section. The Aeronautics Research Division has been engaged primarily in the following research activities:

1. The investigation of radio aids to aerial navigation.

2. The development and refinement of lighting equipment.

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[42] The delegation of power to the Secretary of Commerce is stated in the Air Commerce Act of 1926, Section 3-d as follows: "The Secretary of Commerce shall by regulation * * * provide for the examination and rating of air nagivation facilities available for use of aircraft of the United States as their suitability for such use."

[43] A series of articles by Lyman J. Briggs, Assistant Director of Research and Testing, very ably explains the work of the Bureau of Standards, "Aeronautic Research at the National Bureau of Standards," *Aero Digest,* March, 1929, p. 47, April, 1929, p. 52. May, 1929, p. 48.

3. Wind tunnel tests on the aerodynamic qualities of aircraft.

4. The study of methods of reducing airplane noise.

5. The analysis of special airplane engine problems.

6. The testing of the strength of airplane joints and fittings.

The Radio Section is now developing improvements in airplane transmitting apparatus, in the development of the twelve course radio range and the adaption of marker beacons to this system, in the development of the simultaneous phone and beacon transmitter and many other research activities pertaining to the directive radio beacon systems.[44] It has also conducted an intensive research on the ignition shielding of aircraft engines to prevent radio interference.

The Lighting Section is working constantly on the improvement of all types of lighting devices for use at airports, such as wind indicators and boundary lights; the development of better navigation lights and landing lights carried by airplanes; the study of field flood lighting requirements, airport traffic signals, etc.

The Aircraft Engine Section is now engaged in experimental work in perfecting mercury scales used to measure engine torque. It has developed apparatus to test aircraft engines under conditions of temperature and pressure corresponding to high altitudes.

The Wind Tunnel Section is investigating the stability of airplanes at low speeds and high stalling angles. It is studying the effects of changes in the chord and span of ailerons in the rolling and yawing moments of aircraft at both high and low angles of attack. This work will be of great assistance to manufacturers in determining

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[44] An interesting note on this development is contained in "Aircraft Radio Development," Air Commerce Bulletin, Vol. I, No. 4, p. 5.

the performance of a new type of airplane before it is actually constructed.

The Engineering Section of the Research Division is making a comprehensive study of the means of reducing the noise in the cabins of passenger airplanes. It is also conducting various studies of the use of steel tubing and the strength of welded joints in aircraft construction.

This very short description of the activities of the Aeronautic Research Division will indicate the type of work it is accomplishing. It seems unnecessary to expound on its usefulness or its vital relationship to aeronautic development. It is to be regretted that appropriations will not permit the Research Division to greatly increase its present field of activity.

Summary

In this Chapter public ownership has been urged as the most feasible of airport development.[45] Uniformity in the field and lighting equipment of the airports of the United States seems to be highly advisable from the standpoint of safety. The author, therefore, believes that the efforts of the Aeronautics Branch to foster such uniformity are highly desirable and should be extended wherever possible. The method of checking airway and airport maps, issued by the Aeronautic Information Division, seems inadequate. As a possible solution the recommendation has been made that the duty of checking this data be assigned to the pilot inspectors of the Air Regulations Division. Additional personnel in the

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[45] A most interesting study has been made by Austin F. Macdonald, entitled "Airport Problems of American Cities"; see The Annals of the American Academy of Political and Social Science, September, 1930, p. 225. Chapter 4 of this treatise deals with the question of airport ownership.

Statistics and Distribution Section could be used very advantageously in developing more comprehensive methods of classifying accidents for the statistical use of insurance companies and other interested agencies.

VII

PHYSICAL AIDS TO NAVIGATION

The entire question of the scope and extent of Federal assistance in establishing aids to aerial navigation received much attention previous to the passage of the Air Commerce Act of 1926. Mr. Hoover, then Secretary of Commerce, rather emphatically stated that, "the Government should undertake to give services to commercial aviation comparable to those which the Government has for over a century given to commercial navigation." [1] Colonel Paul Henderson, former second assistant Postmaster-General, also advocated Federal operation and maintenance of the airways. He said in a statement before the Morrow Aircraft Board, "Every precedent is at hand. The Government maintains lighthouses, buoys, and signals, for the joint benefit of all navigators of the seas. The Government contributes large sums for its share in the building of highways. An airway is just a highway of the air, to be used jointly by those who can use it properly." [2]

An airway is, by its very nature, a public right of way. Air navigation cannot hope to succeed unless the Government will provide facilities analogous to those provided for water navigation and land transportation throughout the country. It would be a very unsatisfactory arrangement to have a private company light its own airway if that company could not bar other operators from using their facilities. The only logical solu-

[1] United States President's Aircraft Board, Vol. 1, p. 319.
[2] *Ibid.*, Vol. 1, p. 308.

tion is public operation and maintenance of air navigation aids.

The Air Commerce Act of 1926 provided that all airways under the jurisdiction of the Post Office Department were to be transferred to the jurisdiction and control of the Department of Commerce.[3] The Department of Commerce was further authorized to designate and establish civil airways, and to operate and maintain along such airways all necessary air navigation facilities except airports.[4]

The Interdepartmental Committee on Airways

Acting on the suggestion of President Hoover, the Interdepartmental Committee on Airways was established on May 9, 1929. The major purpose of the Committee is to consider, study and pass on applications for the extension of the civil airways of the United States. The Committee is composed of six men; three representatives from the Post Office Department and three men from the Commerce Department.[5]

In performing its functions, the Committee holds regular hearings for the purpose of entertaining suggestions and applications for the establishment, extension and modification of airways. All interested parties are permitted to express their opinions at these public hearings. It is with the view that this committee will arrive at the best possible solution in the most advantageous extension of our airway system, that it has been authorized to act by the Postmaster General and the Secretary of Commerce.

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[3] By the close of 1926 the Post Office Department had completed 2,041 miles of lighted airways.

[4] Air Commerce Act of 1926, Section 5-b.

[5] *Domestic Air News,* No. 52, p. 25.

Organization

The organization of the Bureau of Lighthouses covered almost the entire United States. The Airways Division was accordingly created in that organization, and its work was to be, so far as practical, carried on under the laws, rules and regulations applicable to the lighthouse establishment. The Airways Division is under the general supervision of the Commissioner of Lighthouses and under the specific supervision of the chief of the Airways Division.[6]

For purposes of administration, the Airways Division has been divided into four sections—Survey, Construction, Weather and Communications, and Radio. The Survey Section determines the route of the airway; selects sites for beacons and landing fields; concludes all negotiations for licensing these sites and for conditioning intermediate landing fields for the use of aircraft. The Construction Section makes all arrangements for the purchase of lighting equipment, and supervises its erection and installation. Most of this work has been performed under contract with private companies. The Weather and Communications Section selects sites for the weather reporting stations and airways communication stations. It also establishes these stations and supervises their operation. The Radio Section obtains the equipment and supervises the installation of all radio accessories used by the communication and radio beacon stations.

In building up an organization for the maintenance of intermediate landing fields and beacon lights, the Commerce Department has utilized seven of the Lighthouse

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[6] Description based on personal study of the Airways Division made in Washington in August, 1929.

Districts,[7] and has added two maintenance organizations to care for the lighted airways in the area from the Mississippi and Missouri River Valleys to the eastern borders of California, Oregon and Washington. Both of these organizations are employed in the maintenance of aeronautical aids alone. They are located at Salt Lake City, Utah, and Fort Worth, Texas.

Units, performing subsidiary functions for the Lighthouse Bureau in its own sphere, have taken over similar work necessary in the operation of the Airways Division. Typical examples are the Divisions of Finance, Law and Property, Personnel, and Files operating in their respective spheres of action for the Airways Division as well as the Bureau of Lighthouses. This obviates the necessity of creating special units for the Airways Division.

Federal appropriations for air navigation facilities have increased heavily since 1927. The table below will indicate this growth:

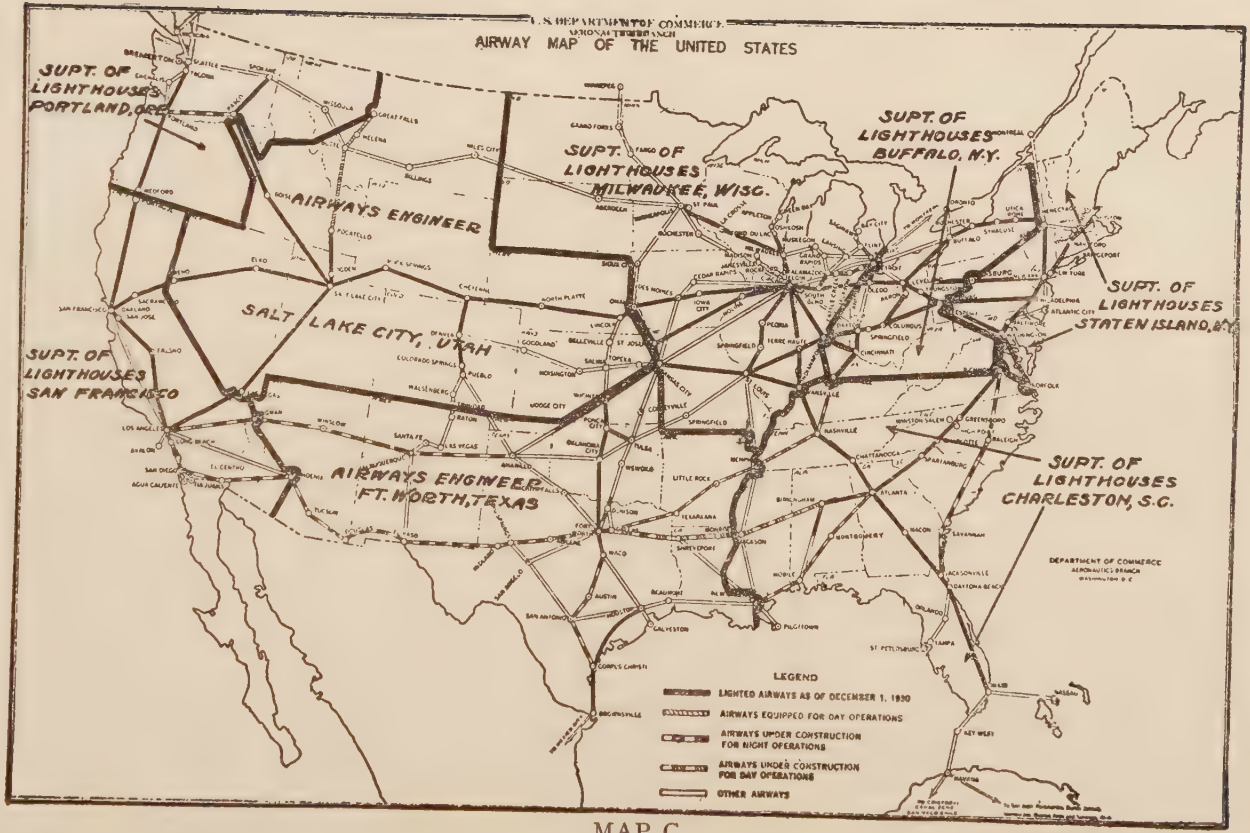
Fiscal Year	Appropriations for Air Navigation Facilities
1927	$ 300,000
1928	4,091,500
1929	3,659,850
1930	5,458,620
1931 (estimated)	7,271,600

The growth of actual facilities offered by the Federal Government is as follows:

	1926	1927	1928	1929	1930
Mileage of Lighted Airways	2,041	4,468	6,988	10,183	13,500 [8]
Intermediate Fields, Lighted	92	134	210	285	319

[7] The following Lighthouse Districts are now used for airways maintenance: Third Lighthouse District, Staten Island, N. Y.; Sixth Lighthouse District, Charleston, S. C.; Tenth Lighthouse District, Buffalo, N. Y.; Twelfth Lighthouse District, Milwaukee, Wisconsin; Seventeenth Lighthouse District, Portland, Oregon; Eighteenth Lighthouse District, San Francisco, California. (See Map C.)

[8] Estimate made by Mr. C. I. Stanton, Airways Engineer.


U.S. DEPARTMENT OF COMMERCE
AIRWAY MAP OF THE UNITED STATES
SUPT. OF LIGHTHOUSES PORTLAND, ORE.
SUPT. OF LIGHTHOUSES MILWAUKEE, WISC.
SUPT. OF LIGHTHOUSES BUFFALO, N.Y.
SUPT. OF LIGHTHOUSES STATEN ISLAND, N.Y.
SUPT. OF LIGHTHOUSES CHARLESTON, S.C.
SUPT. OF LIGHTHOUSES SAN FRANCISCO
AIRWAYS ENGINEER SALT LAKE CITY, UTAH
AIRWAYS ENGINEER FT. WORTH, TEXAS
DEPARTMENT OF COMMERCE AERONAUTICS BRANCH
LEGEND
LIGHTED AIRWAYS AS OF DECEMBER 1, 1930
AIRWAYS EQUIPPED FOR DAY OPERATIONS
AIRWAYS UNDER CONSTRUCTION FOR NIGHT OPERATIONS
AIRWAYS UNDER CONSTRUCTION FOR DAY OPERATIONS
OTHER AIRWAYS

MAP C

Maintenance Offices for Federal Air Navigation Facilities

U.S. DEPARTMENT OF COMMERCE
AERONAUTICS BRANCH
AIRWAY MAP OF THE UNITED STATES
SHOWING AIRWAYS EQUIPPED WITH FEDERAL AIDS TO AIR NAVIGATION
LEGEND
LIGHTED AIRWAYS AS OF DECEMBER 1, 1930
AIRWAYS EQUIPPED FOR DAY OPERATIONS
AIRWAYS UNDER CONSTRUCTION FOR NIGHT OPERATIONS
AIRWAYS UNDER CONSTRUCTION FOR DAY OPERATIONS
OTHER AIRWAYS
DEPARTMENT OF COMMERCE
AERONAUTICS BRANCH

MAP D

Airways Equipped with Federal Aids to Air Navigation

The Airways Division is maintaining a total of 1477 airway beacons along the 13,500 miles of lighted airways.[9] The division also is operating 35 airway radio communication stations and 9 radio range beacons. The Weather Bureau offers the services of 200 airway weather reporting stations, and 207 regular stations.

Methods Employed in Airways Survey

The principal source of revenue of most of the successful air transport companies is the transportation of air mail and expenses. Night flying is essential for this type of business. It is necessarily more hazardous than day flying, due to poor visibility, imperfect observation of weather conditions, and the changeable weather which generally prevails during the hours of darkness. To minimize these hazards, the Commerce Department has been authorized to establish aids to air navigation.

In general, it is the engineering practice to lay out an airway along the shortest distance between the terminal points. Pilots from the Survey Section fly over the proposed route carefully studying a strip of approximately twenty-five miles in width. The airway route selected embraces as many miles as possible of open country, and avoids, if possible, wooded or mountainous country. Since the airway will be used by day as well as by night, it is important to take into consideration identifying land marks such as main roads, railroads, centers of habitation and electric power lines.[10]

The aerial survey is supplemented by a ground survey to check the results of the aerial survey and afford additional information. The shortest route, embracing

[9] Figures for June 30, 1930. Map D indicates the present Federally lighted routes.

[10] Information based on interview with Mr. C. I. Stanton, Airways Engineer.

the best combination of all factors conducive to safety, is selected. Sites are chosen for intermediary emergency landing fields, radio beacons and light beacons.

Light beacons are placed at ten-mile intervals along an airway. Variances from ten-mile intervals and from standard airway line are many times made in order to take advantage of roadside locations and commercial electric power, and also to make use of the highest elevations to insure the greatest visibility. When the topography is exceptionally irregular, auxiliary beacons are also employed to give light-to-light vision.

Intermediate fields are placed at thirty-mile intervals on airways. Nearness to good roads and centers of habitation are important in the consideration of possible sites. In mountainous regions the scarcity of level land suitable for a landing field forces the selection of many fields whose sole attribute is their possibility of affording a safe landing area.

After the best sites have been chosen for beacons and intermediate fields, these areas are leased for occupancy and use. A ground survey is made of each field to determine the amount of work necessary to make it suitable for airplane use. The necessary conditioning and construction work is performed under contract.

During the construction period, a survey is made in conjunction with representatives of the Weather Bureau for the purpose of locating sites for weather and communication stations. These are established during the construction period. The completed airway is turned over to one of the districts of the Lighthouse Bureau for maintenance.

On June 30, 1929, the Airways Division reported a personnel of 13 experienced airplane pilots and 10 civil engineers doing survey work. Five airplanes were avail-

able for their use, 4 electrical and structural engineers and 18 inspectors of airways construction were engaged in the establishment of lighting equipment.

Intermediate Fields

The average intermediate field in low altitudes has an area of 47 acres.[11] The standard field provides two landing strips or runways or a length of 2000 feet and width of 600 feet, approximately at right angles to each other, with one strip lying in the direction of the prevailing wind. Fields located in altitudes of over 4000 feet require longer landing strips. They average 2500 to 3000 feet in length. In mountainous or rough country, it is often possible to secure only one landing strip.

It is the practice of the Airways Division to lease intermediate fields for a period of five or ten years, with occupation for an indefinite period beyond the license term, subject to termination by either party upon six months' notice. The average cost per annum rental per acre has been exceptionally low, amounting to only $4.71. Beacon sites, similarly licensed, have averaged $4.63 per site per annum.[12]

Marking and Lighting Intermediate Fields

Intermediate field marking is described in the report of the Airways Division to the Director of Aeronautics. These fields "have been marked by 50 foot diameter white circles at the intersections of the runway center lines, with white panels 20 feet long and 2 feet wide extending from the outside of the circle along the runway center lines to indicate the landing directions. It is pro-

[11] A description of the intermediate field is given by F. C. Hingburg, Chief Engineer of the Airways Division, in an article issued by the Division titled, "Air Navigation Facilities."

[12] Figures secured from the records of the Airways Division.

posed to increase the size of these markers to a diameter of 100 feet for the circle with a 4 foot band and to a length of 100 feet and width 4 feet for the runway markers. The boundaries of the field are marked by chrome yellow sheet metal cones 30 inches in diameter and 24 inches in height, installed immediately below the boundary lights and attached to the boundary light standards. It is proposed to augment these boundary markings by installing 70 foot sections of painted fence at each angle of the field boundary, and at 600-foot intervals on long straight lines." [13]

The lighting of an intermediate field consists of a beacon, course lights, boundary lights, and an illuminated wind indicator. The beacon is generally of the 24 inch revolving type. Boundary lights are installed at 300 foot intervals around the field. Course lights using white and green globes indicate the landing strips. All obstructions are marked by red lights at the height of these obstructions. A conventional wind cone or "sock" is provided at each field, properly lighted with a white globe. The average cost of light installation is about $5,000 per field.[14]

Financing of Intermediate Fields

The Airways Division is forbidden by the Air Commerce Act to expend any money for the lighting of airports or terminal landing fields.[15] It is permitted to light an intermediate field or an established airway. It has been the practice of the Commerce Department to establish many intermediate fields on a coöperative basis with the towns located near these intermediate fields. This

[13] Annual report of Airways Engineer to Director for Aeronautics, 1929.
[14] Figures from Accounting Department of Airways Division.
[15] Section 5-B.

condition accounts for the low rental average per acre. The city or town at which the field is located would rent or buy the field and lease it to the Government at a nominal cost. The cost of properly lighting the field is generally too heavy a burden for the local community and the Commerce Department performs this service. This places the field in the category of an intermediate field and precludes its use as an airport. Despite the fact that the city or town has materially contributed in the fields establishment, rule 2 of the Intermediate Landing Field states that these fields "are established under the authority of the Air Commerce Act to provide for safety of the aeronautical public in cases of emergencies, and no exclusive rights, preferential privileges, or commercialization of any emergency field will be permitted.[16] Most of these fields would be established at definite points whether the adjacent town contributed to it financially or not. The result has been that many towns have been contributing to the rental of the field and in return the Commerce Department cannot permit them to use the field any more than the town that has refused to contribute anything.

This condition seems to work an injustice on those communities that possess sufficient public spirit to assist in the establishment of intermediate fields. These contributing communities should be permitted the full use of the field, because it would aid the Government in obtaining more landing fields and would encourage local interest in flying. An amendment to the Air Commerce Act would probably be necessary to legalize such use, if the Commerce Department supplied the lighting equipment.[17]

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[16] These rules are contained in *Domestic Air News*, No. 37, p. 6.

[17] Section 5-B would have to be amended so as to permit local use of an emergency intermediate field as an airport.

Airway Beacons

The standard practice of the Airways Division is to place a beacon every ten miles along lighted airways. Every third beacon is generally located on an intermediate field. The beacons are placed as near as possible on the airline from airport to airport.

The most common type of beacon now used consists of a 1000 watt searchlight fitted with a 24-inch parabolic mirror giving it a beam candlepower of 1,000,000. The beacon is mounted on a steel tower of a standard height of 51 feet.[18] Two course lights are mounted on the tower below the beacon; one pointing forward and the other pointing backward on the airway. Astronomic clocks are used to turn the beacons on and off at sunset and sunrise. These clocks are used only at beacons using commercial electric power. A clock designed to operate on beacons using gasoline engine genators is now being service tested. This type now requires the services of a caretaker.

The Airways Division has been forced to meet a difficult problem in lighting the airways through desert regions where neither commercial power or caretakers are available. It has solved this problem by using a lower candlepower acetelene light at a spacing of three and one-half miles.[19]

Maintenance of Airways

After the installation of an airway has been completed it is turned over to the Lighthouse Service district offices for maintenance. Associate and assistant airways engineers are assigned to each of the Lighthouse Dis-

[18] Towers of standard construction are also available in 20, 62, 75 and 87 feet heights, where conditions indicate desirability of heights other than 51 feet.

[19] Interview with C. I. Stanton, Airways Engineer.

tricts. These men work under the general supervision of the lighthouse superintendents. Field maintenance of beacons is accomplished by airway mechanicians. Assigned units consist, generally, of 175 mile sections of the airway. These sections are patrolled by mechanicians who are provided with small panel body motor trucks. Becons must be checked at least two times per month. A caretaker is assigned to each of the intermediate landing fields. Most of the beacons have part time attendants. It is their duty to report any failures in the functioning of lighting equipment. On June 30, 1929, the Airways Division was employing 20 airway engineers, 72 airway mechanicians, and 782 caretakers and attendants. The average cost of airway maintenance during the fiscal year 1928-29 was $209.05 per mile as compared with a construction cost of $370 per mile.[20]

The present mileage of approximately 13,500 miles will, therefore, cost the Government over $2,800,000 to maintain for one year.[21] Additional airways are being constructed rapidly. The expense of construction plus the mounting maintenance costs will necessitate large appropriations in the very near future. At the 1929 convention of the National Aeronautical Association, Senator Bingham warned the delegates that Congress was becoming nervous about the rising costs for airway construction and maintenance, and suggested that the states be impelled to build their own airways and especially to spot in emergency landing fields scattered over their area so that a pilot in trouble could always be sure of having a landing field within a few miles.[22]

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[20] Records of Airways Division, Washington, D. C.

[21] The lighted airway mileage as of June 30, 1930, was reported as 13,500.

[22] Proceedings of this convention are reported in *Aviation*, September 14, 1929, p. 564.

The State of Pennsylvania has already started a survey of an airway from Philadelphia to Pittsburgh.[23] This survey is being made under authority of the State "Aeronautics Act" which provides that the State Aeronautics Commission shall have authority to "designate, establish and chart civil airways, within, over, and above the lands or waters of the Commonwealth of Pennsylvania."[24] It is the intention of the Aeronautics Commission to completely equip airways of the state with beacons and intermediate fields. It is hoped that maintenance of these airways will be taken over by the Federal Government.[25]

State assistance of this nature would relieve some of the burden from the Federal Government, but it has the disadvantage of possible lack of uniformity in methods of construction among the various states. The author suggests a policy similar to the aid granted to the states in constructing highways. The states carry the major portion of the cost, but the Federal Government secures uniformity and sound construction methods by withholding aid until their standards have been complied with. State assistance is advisable, but uniformity is essential. The average pilot experiences sufficient difficulty in mastering the intricacies of the Federal system of colored lights, blinker signals and intermediate field night markings. If several of the states set up airway signals and lighting systems of their own invention, it would most probably result in considerable confusion to the pilot. Uniform Federal standards could be easily

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[23] Idaho, Virginia and New York have also expended money to establish adequate landing fields and lay intrastate airways. See *Philadelphia Public Ledger,* November 24, 1929, p. 6.

[24] Pennsylvania P. L. 316, Section 201-G.

[25] Aeronautics Laws of the Commonwealth of Pennsylvania, published by Department of Property and Supplies, Harrisburg, 1929.

established in state airway construction by the use of the subsidy system.

The Certification of Private Aeronautical Lights

During the past several years many individuals and corporations have erected aeronautical beacons for advertising purposes.[26] Regulations promulgated under authority of the Air Commerce Act provide for the certification of private aeronautical lights which, in the judgment of the Department of Commerce, serve as true aids to aerial navigation.[27] The Department requires that these lights be aeronautical in character, mark a safe landing field or serve as a landmark on a course leading to such a field, and be in reliable operation from sunrise to sunset every night in the year.

Applications for certification of private aeronautical lights are made directly to the Commissioner of Lighthouses.[28] It is the policy of the Department to submit each application to the aeronautical interests in the area for which the light is proposed and decision for or against certification is based upon the recommendations of these interests. The certification of a private light by the Department obligates the donor to continuously operate the light and report immediately by wire any failure of the light to function.

It is important to note that lights not certified by the Department of Commerce and which become the subject of complaints from air pilots, owing to the fact that they are confusing with true lights, may be ordered

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[26] Air Commerce Bulletin, Vol. I, No. 1, reports, for example, the erection of a beacon atop the Hotel Hussman at El Paso, Texas, and a second beacon maintained by the Richfield Oil Co. at Goshen, Calif.

[27] Air Commerce Act of 1926, Sections 2, 3, 9.

[28] Form 117-b, entitled "Application for certification, rating or discontinuance of aeronautical light."

discontinued by the Department. Authority for such an action is based on Section 11 of the Air Commerce Act, which makes unlawful the displaying of any false light or signal.

Weather Service and Communications

The vital importance of adequate weather service for aeronautics is universally recognized. Weather is one of the uncontrollable factors that must be reckoned with in providing safe and reliable air transportation.

The Air Commerce Act of 1926 assigns to the Weather Bureau of the Department of Agriculture the duty of furnishing "weather reports, forecasts, warnings, and advices, as may be required to promote the safety and efficiency of air navigation in the United States. . . and for such purposes to observe, measure, and investigate atmospheric phenomena, and establish meteorological offices and stations."[29]

The Weather Bureau is the responsible agency for the collection and dissemination of weather information. The Airways Division operates with the Weather Bureau in communicating weather information along the airways. This new service of the Weather Bureau is, of course, an extension of that already existing for the general public, which consists of twice-daily reports from all parts of the country and forecasts based thereon. This service did not prove adequate for the needs of transport operators, but it did provide a groundwork for expansion of services more suitable to the needs of aviation.

Rapid expansion was effected in establishing additional upper-air meteorological stations.[30] Reports on upper wind directions and velocities are helpful in

[29] Air Commerce Act of 1926, Section 5-E.
[30] Forty-five upper-air stations were in operation on June 30, 1929.

enabling the pilot to select the most favorable altitudes for flying but are not of as vital importance as similar reports indicating the conditions at the surface. Surface fog, low flying clouds, excessive rain, sleet, or snow make flying very hazardous. Particular attention is given to ground conditions, not only at the upper-air stations, but also at over 200 stations where observations are confined to surface weather.

The Airways Division disseminates the weather information received from the Weather Bureau. Radio stations have been established along the airways. This system of communication is supplemented by telephone and teletype for local communications between weather reporting stations along the airways. Teletype circuits are now used for transmission of hourly reports on the New York-Chicago and the Los Angeles-San Francisco airways. This service will be continued through the year 1931.[31]

Experience has shown that weather reports should be supplied at more frequent intervals to be of real value to transport operators. The ideal system would be the continuous exchange of weather reports along the airways from all the reporting stations along the airways and from points on each side of the airways. Lack of finances have hindered the realization of such an ideal system.

During the year 1931 there will be put into operation a plan to furnish reports at three hour intervals along the entire transcontinental airway.[32] To effect this plan,

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[31] Short description of the communication system is contained in "Airways Weather and Communications System for Safe Night Flying," Release November 1, 1928, Airways Division. For descriptive maps of communication and radio beacon stations see *Aviation*, November 16, 1929, page 979.

[32] Air Commerce Bulletin, Vol. I, No. 8, p. 6.

weather stations will be established from 150 to 200 miles on each side of the airway and at approximately the same intervals along the airway.[33] Communication stations will receive reports from all of the weather stations. Four major control stations will compile these reports and prepare a resume of weather conditions to be broadcasted simultaneously by all of the communication stations. Meteorologists located at airports will be able to supply information concerning current conditions and also use resume reports as a basis for route forecasts for flights of five to six hours duration.

It is also proposed to develop a plan to broadcast from all communication stations, reports of weather conditions at terminal airports. These reports will be made every half hour so that pilots will have information concerning the weather at their destination.

Mr. W. R. Gregg of the United States Weather Bureau, in speaking of the tremendous growth of aviation says, "This development means a similar expansion and intensification of weather service. Such service is possible, but to be effective it must have the whole-hearted support of pilots and operators; it must be made more perfect through research, and it must be of the up-to-the-minute type through a fast and dependable system of communications. With such a service functioning on all of the airways, the hazards of flight which now unfortunately, and in a large measure unjustifiably loom large in the public consciousness, will vanish, and by this cooperation between the pilot and the weather man, aeronautics will truly 'come into its own.' "[34]

Mr. Gregg referring to meteorology "more perfect

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[33] For an excellent description of an hourly system employed by the Guggenheim Experimental Meteorological Service, see *Aviation,* February 2, 1929, p. 322.

[34] Report of the First National Aeronautical Safety Congress, p. 693.

through research" implies a more thorough study of the conditions that produce and dissolve fog, the occurrence of haze, causes of the formation of low clouds, and the forecasting of conditions favorable to the formation of ice on aircraft.[35] Other problems of probably lesser importance but nevertheless requiring further research are—the causes of certain violent disturbances such as tornadoes, squalls, etc. Little is known about gustiness and vertical convection, a factor which probably caused the destruction of the Shenandoah.

The importance of a close contact between the meteorologist and the pilot is stressed by Mr. Gregg. It would serve as a means of giving the meteorologist the pilot's point of view and allow him to check his forecasts from the pilot's observations. The transport operator would receive better meteorological service if he co-operated with the meteorologist by permitting him to accompany the company's planes on some of their regular schedules. Mr. Gregg's comment on "expansion and intensification of weather service" has already been discussed in sufficient detail.

Radio Aids to Aviation

The Federal Radio Commission[36] has reserved 50 radio channels for airplane radio communication. Allotment of channels have been made to airways rather than to operating companies. This policy has the effect of continuing radio communication over specific airways on

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[35] For further discussion of these problems see Willis Ray Gregg, "Meteorology," *Aero Digest,* February, 1929, p. 49; Carl G. Rossby, "Organization of Weather Service for Safe Flying on an Airway," Report of First National Aeronautical Safety Conference, p. 675; also, "Aircraft and the Thunderstorm," *Aviation,* November 16, 1929, p. 981.

[36] Authority of the Commission is defined in Form 81-A of the Department of Commerce (Lighthouse Service.)

the same frequency regardless of the identity of the operating companies.

The radio is now used for communication from station to station, the broadcasting of weather reports, communication to aircraft in flight, and for guiding aircraft from airport to airport by means of radio beacons. The further extension of the use of radio offers the most promising solution to the further mastery of adverse meteorological conditions. The intensive work of the Bureau of Standards, in the past two years, has resulted in the development and demonstration of a complete set of radio aids to flying on the civil airways.[37]

The system of weather communication service employed on the transcontinental airway is typical of the best system now being used in the United States. The transcontinental route has been divided into six sectors with control centers located at Salt Lake City, Omaha and Cleveland. Two weather sectors will be controlled from each control center. The six weather sectors are San Francisco-Salt Lake sector, and Salt Lake-Cheyenne sector, controlled from Salt Lake City; Cheyenne-Omaha sector, and Omaha-Chicago sector, controlled from Omaha; Chicago-Cleveland sector and Cleveland-Newark sector, controlled from Cleveland.

Each sector has two or three radio communication stations connected by leased wires for chain broadcasting so that reports will cover the entire sector. All weather reports are gathered at the control centers and weather information and landing conditions along the route are broadcast at frequent intervals. This radio broadcasting system makes it possible for the pilot to be kept advised

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[37] F. C. Hingsburg, Chief Engineer Airways Division, "Radio for Safe Flying," Release May 13, 1929.

of all changing weather and landing conditions along the route and at his terminal field.[38]

The Directive Radio Beacon

The Bureau of Standards has developed a directive radio beacon system that should prove of tremendous value in promoting greater safety in air navigation.[39] This beacon system marks out an invisible radio course along which pilots may fly regardless of fog or other weather conditions.

The directive radio beacon station, very briefly described, has two loop antennas at an angle with each other. Each of these emits a set of waves which is directive, i.e., it is stronger in one direction than in another. When an airplane flies along the line equally distant from the two beams of radio waves, it receives signals of equal intensity from the two. If the airplane gets off this line, it receives a stronger signal from one or the other of the beams.

In the aural type of reception, the pilot receives the signals by means of ear phones placed in the helmet. The pilot follows the course over the airway and receives the radio signal from the directional beacon. The signals from the two loops interlock with equal intensity on the true course forming a series of continuous dashes. If the pilot should drift to either the right or left of his true course, the directional signal from one of the loops would increase in intensity, and knowing the characteristic of the signal on each side of the course he could

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[38] See Air Commerce Bulletin, Vol. 1, No. 8, p. 7, for a description of types of radio equipment used.

[39] An excellent description of early research on the directive beam is described in the Bureau of Standards Scientific Paper No. 480.

change his direction until he was again following the marked radio channel to his destination.[40]

The use of telephone receivers and determination of location by distinguishing certain aural signals requires skill and entails a certain strain upon the pilot. The Bureau of Standards has accordingly experimented with a number of visual indicator systems. The form finally adopted consists of two vibrating steel reeds. Their vibration provides the visual indication. The two reeds are tuned to different modulating frequencies used on the two antennas at the directive radio beacon station. If the vibrations of the two reeds are equal, the pilot knows he is on his course. If the reed on the right becomes longer, the airplane has drifted off the course to the right. If he drifts off the course to the left the white line of the reed on the left becomes longer.[41]

The Airways Division now has seven radio beacon stations in operation at New Brunswick, Bellefonte, Cleveland, Goshen, Sterling, Des Moines and Key West. These stations provide a continuous radio marked course from Omaha to New York and from Key West to Habana. The New Brunswick beacon also marks 800 miles of the airways to Boston and Atlanta. The radio marking of the New York to Boston airway has just been completed.

The Multicourse Radio Beacon

In the research work planned for 1931, the Bureau of Standards intends to work out a practical development of the multicourse beacon. Four courses are obtainable from the ordinary type of radio beacon station. These

[40] Typical characteristics of radio range signals are as follows: Type 1, dash dot, dot dash. Type 2, dash dot dot, dot dot dash.

[41] A technical description of this type of beacon may be found in the Bureau of Standards Journal of Research, November, 1928. Research paper No. 28.

are directed along the four bisecting lines of the two crossed loop antennae. Four beacon courses are sufficient at most airports, but the radiating airways are not usually at 90° with each other. It has been possible to shift the beacons to correspond with the radiating airways. At Hadley Field, New Brunswick, three courses are served by one radio station, leading to Hartford, Conn., Bellefonte, Pa., and Washington, D. C. To give the beacon system even greater flexibility, a new beacon capable of serving twelve courses has been developed.[42]

Marker Beacons

The directive beacon successfully guides the pilot along the course, but gives him no indication of the distance traversed along it. It is planned to install non-directive "marker becons" along the airmay to give the pilot this information. These "marker beacons" will be of very low power and emit a characteristic signal which the pilot will receive for two minutes. This signal will tell the pilot when he is passing over a specified point. By keeping track of these marker beacons, the pilot will be able to gauge wind conditions and note any changes in direction or velocity. Each marker beacon will send the characteristic signal assigned for its location. This signal may coincide with the characteristic flash signal of the light beacon on the same location.[43]

Summary

Because of the public nature of an airways system, it is logical to assume that most of the aids to naviga-

[42] For a technical description of this beacon see Air Commerce Bulletin, Vol. I, No. 4, p. 8.

[43] Interview with Mr. Harry Diamond, Radio Engineer, Bureau of Standards, August 29, 1929.

tion must be offered by some governmental agency. Most of the aids have been established and maintained by the Federal Government. It may be that an increasing number of states will follow the lead of Pennsylvania in assisting airway development by providing aids independently of the Federal Government. If this should be the future tendency of the states, it would seem advisable to direct such assistance with the goal of insuring uniformity in construction. The author suggests enlargement of the Federal policy of grants in aid to the states to include subsidies for airway construction.

In reference to local assistance in the financing of intermediate fields, it is suggested that communities so assisting construction should be permitted the full use of the field as a local airport. Such a suggestion would embody an amendment to the Air Commerce Act modifying Section 5-B.

VIII

SAFETY

What is the policy of the Federal Government in promoting safety in aviation? Mr. William P. MacCracken, former Assistant Secretary of Commerce, states that the Federal policy embraces four essentials:[1]

1. Airworthiness of craft.
2. Competent personnel.
3. Uniform air traffic rules.
4. Adequately equipped airways.

As a result of the pursuance of this policy, Mr. MacCracken concludes, "While there is much room for improvement, it is gratifying to note that this program of the Federal Government, which, as a whole, has been in effect for less than two years, has done much to increase public confidence, as well as to reduce the dangers in air operation. Perfection is impossible of attainment, but sufficient experience has been gained to indicate that air transportation will not only be relatively as safe as any other means of transportation, but eventually will be the safest means of transportation."[2]

Whether the Federal Government engages in aeronautical activities involving regulation, promotion, research or construction of aids to navigation, the sought for result is greater safety. The statistical study of accidents form the basis of the future trend of Federal aviation activities. The statement of Mr. E. P. How-

[1] Report of the First National Safety Conference, p. 774.
[2] *Ibid.*, p. 777.

ard, Chief of the Regulations Division, will illustrate this point. "An analysis and tabulation of aircraft accidents, no matter how minor the accident, is of vital importance to the Aeronautics Branch. Through a detailed study of these accidents gratifying progress is being attained toward accurately determining their causes and preventing, to a great extent, their recurrence."[3] Constructive regulation, promotion, and research is dependent upon an efficient method of accident analysis.

Aircraft Accidents—Method of Analysis

To create a standard method of analysis, the Executive Committee of the National Advisory Committee for Aeronautics appointed a special sub-committee to study the nomenclature, subdivision, and classification of aircraft accidents. This committee was under the chairmanship of Dr. George K. Burgess, Director of the Bureau of Standards. The committee appointed on March 1, 1928, was composed of members from the National Advisory Committee for Aeronautics, the Army Air Corps, the Navy Bureau of Aeronautics, and the Aeronautics Branch of the Department of Commerce. Quoting from the committee's report, "The work was undertaken in recognition of the difficulty of drawing correct conclusions from efforts to analyze and compare reports of aircraft accidents prepared by different organizations using different classifications and definitions."[4] It was recognized at the outset that no uniform definitions or adequate methods of analysis of aircraft accidents existed.

The committee held 15 meetings, submitting its final report on August 15, 1928.[5] It is now used as the

[3] Interview, August 26, 1929.
[4] N. A. C. A., Report No. 308, p. 5.
[5] N. A. C. A. Report No. 308.

basis of aviation accident causation findings in the Army, the Navy and the Aeronautics Branch. The N. A. C. A. definitions divide "nature of the accidents" into thirteen groupings. They are:

Class A. Collisions in full flight with other aircraft.
Class B. Collisions in full flight with objects other than aircraft.
Class C. Tail spins, following engine failure.
Class D. Tail spins, without engine failure.
Class E. Forced landings.
Class F. Landing accidents.
Class G. Take-off accidents.
Class H. Taxying accidents.
Class I. Fires in the air.
Class J. Carrier, platform and arresting gear accidents.
Class K. Launching gear accidents.
Class L. Miscellaneous.
Class M. Indeterminate and doubtful.

A second classification divided accidents into classes according to the injuries suffered by the personnel. There are four such classes:[6]

Class A. An injury resulting in the death of the individual within a period of ninety days.
Class B. Serious injuries, any injury incapacitating the individual for more than five days is considered as severe. All others are classified as minor.
Class C. Minor injuries.
Class D. Any persons who experience an aviation accident with no personal injury are classified as class D.

[6] *Ibid.*

The third classification is based on "damage to materiel":

Class A. All accidents as a result of which the airplane is of no further value except for salvage, commonly termed a "washout."

Class B. Accidents requiring complete overhaul of the airplane.

Class C. Accidents requiring replacement of some major assembly of the aircraft, such as a wing, fuselage, undercarriage, tail, or engine.

Class D. Damage to aircraft easily repaired, such as a broken tail skid, wheel, bent propeller tip, etc.

Class E. All accidents similar to "Class D" but involving no damage to materiel.

Class F. All materiel failures which did not result in an accident. (This classification does not actually fit into an accident analysis, but was included because of the interest of different organizations. An example would be a successful landing after an engine failure.)

The three classifications above are the tabulations of the *results* of accidents with division into classes and extent of injury to personnel and materiel. Further classifications are made for "immediate standard causes" and "underlying causes" of accidents. Under "immediate standard causes" the committee lists:

1. Errors of pilot, including errors in judgment, poor technique, disobedience of orders, carelessness, negligence and miscellaneous.

2. Errors of supervisory personnel other than pilots.

3. Errors of other personnel, such as members of the flight and ground crews of the aircraft.

A second group classified failures of materiel.

1. Power plant failure with further subdivisions for failure of the fuel system, cooling system, ignition system, lubrication system, propeller and propeller accessories, engine control system and miscellaneous.

2. Structural failures, divided into failures of flight control system, movable surfaces, stabilizing surfaces, wings, struts and bracings, landing gear, wheels, tires and brakes, seaplane float or boat, fuselage, engine mount, arresting appliances on aircraft and miscellaneous.

3. Handling qualities resulting from peculiar characteristics of certain types of aircraft.

4. Instruments, failure to function.

5. Launching devices, failure or malfunctioning of catapults.

6. Arresting devices, failure of arresting gear to function. (These devices are not a part of the aircraft).

A third grouping is termed miscellaneous. It includes:

1. Accidents caused by weather conditions which could not reasonably have been foreseen.

2. Darkness conditions which could not have been reasonably foreseen.

3. Airport or terrain conditions which could not have been reasonably detected or foreseen.

4. All other accidents resulting from causes not otherwise accounted for above.[7]

To make any accident analysis method possess real value, it would be necessary to go one step further in causation allocation. The N. A. C. A. report has done this under its classification "underlying causes of aircraft accidents." Underlying causes of errors of the pilot are frequently of greater interest than the actual causes

[7] N. A. C. A. Report No. 308, p. 13.

themselves. Under the classification "errors of pilot" the committee has listed the following standard underlying causes: (1) Lack of experience, with subdivisions of "lack of total general experience" embracing those accidents resulting from the condition that the pilot has never engaged in such work for sufficient time to have acquired the necessary experience to avoid such accidents. "Lack of recent general experience" implying lack of recent experience in the specific type of flying in which the accident occurred. Another subdivision includes accidents resulting from "lack of total special experience, including all accidents resulting from a lack of experience in special problems of aviation, such as certain features of cross-country flying requiring an intimate knowledge of the terrain of a certain section, night flying, blind flying, etc."[8]

Certain physical and psychological causes of errors in pilotage are also listed as standard underlying causes. These causes include inherent or temporary diseases or defects such as overshooting a field, faulty landings or collision due to defective vision or judgment; hysterical or epileptic tendencies; chronic air sickness, etc. Accidents resulting from psychological causes which apparently are not susceptible to correction within a reasonable period of time are listed as temporary and inherent poor reactions. They would include accidents resulting from the pilot's slow or erroneous reaction in choosing what is manifestly the better of two fields for an emergency landing, persisting on a course when good judgment would indicate that he should turn back or attempt a landing, etc.

Material failures are also analyzed for underlying causes. These are subdivided into faulty operating and

[8] N. A. C. A. Report No. 308.

maintenance instructions including accidents resulting from materiel failures where such materiel was operated in accordance with standard instructions of operation or maintenance which proved to be incorrect or incomplete, such as instructions governing the proper engine operating temperature which, when carried out, are found to damage the engine, or instructions governing the type of protective coating to cover duralumin parts when such covering does not prevent erosion. Another subdivision covers materiel failures attributable to faulty factory, overhaul, or maintenance inspection. Other materiel failures might result from originally defective materiels, or deteriorated materiels. A final underlying cause of materiel failure is traceable to faulty design, subdivided into defects of structural strength, arrangement, or aerodynamic qualities in the original design or faulty design due to defects occurring in modifying the original design because of necessary repairs or modification to secure greater efficiency.

Typical Analysis of an Accident

To illustrate the actual functioning of the accident analysis method, the National Advisory Committee for Aeronautics has included a typical analysis of an accident in their report.[9]

> Pilot John Doe was flying in a seaplane at an altitude of 200 feet over a point of land between a bay and the open sea when the engine stopped. Pilot Doe had an opportunity to land either directly into the wind in the open sea or cross wind in the bay. He started to land in the ocean, but at 100 feet altitude he changed his mind and attempted to turn so as to land in the bay. In turning, Doe held the nose of the seaplane up, stalled it, and spun into the land.

[9] N. A. C. A. Report No. 308.

> The airplane was demolished, the pilot was seriously injured, and the passenger was killed. Doe, according to his record, was an experienced aviator with 30 hours flying during the previous month and with recent experience in stunting airplanes. Examination of the magneto showed that one of the teeth in the magneto timing gear had stripped, having been drawn into the other teeth, causing the eventual stripping of all teeth. The original break was determined to be a visible hardening crack.

The nature of this accident was Class C,—tail spin following engine failure. Injury to personnel: Pilot, Class B, serious. Passenger, Class A, fatal. Damage to aircraft: Materiel, Class A, washout.

For the "immediate cause" of this accident, 75 per cent is charged to "Personnel" and 25 per cent to "Materiel." The greater percentage is charged to "Personnel" because the pilot had two chances to make a safe landing and took advantage of neither of them. Since "Errors of supervisory personnel" and "Errors of other personnel" were not factors in this accident, the whole weight, 75 per cent, must be placed under "Errors of pilot." For a further subdivision of the heading "Errors of pilot," it appears that the errors of the pilot involved errors of judgment in that he lost altitude while wavering indecisively between landing in the ocean and attempting to land in the bay, and of even greater importance, he exhibited poor technique in that he continued to pull the nose of the plane up, still further stalling the plane, when he should have sensed the approaching stall. The approximation arrived at charges 35 per cent to "Error of Judgment" and 40 per cent to "Poor Technique."

In analyzing the "Underlying Causes," the "Error of Judgment" and "Poor Technique" appear to be both due to "Temporary Poor Reaction" with a strong pos-

sibility of such poor reaction being "Inherent" rather than "Temporary."

The 25 per cent assigned to "Materiel" is obviously charged to "Power Plant Failure" under the further subdivision "Ignition System." The underlying cause of the material failure is faulty manufacturing and would be placed under the head of "Manufacturing Inspection."

The Accuracy of the N.A.C.A. Analysis Method

It may seem that the method of charging percentages to various accident causations is arbitrary and places too much reliance upon the good judgment of the personnel making the analysis. Mr. E. P. Howard, Chief of the Air Regulations Division, believes that much of the possibility of such an occurrence is precluded by the expert knowledge and experience of the personnel engaged in this work.[10] The N. A. C. A. method of accident analysis is now being employed by three agencies in the United States, the Army Air Corps, the Bureau of Aeronautics of the Navy Department, and the Aeronautics Branch of the Department of Commerce. The accident causation percentages of these three agencies, separately compiled, bear a striking similarity to each other.[11] Military and civil statistics prepared in England, France and the United States have also shown similarity in results.[12] In the opinion of Mr. E. P. Howard, this resemblance in statistics indicates a fair degree of accuracy.

In particular instances, mistakes will be made.

[10] Interview with Mr. E. P. Howard, August 23, 1929.

[11] Fifteenth Annual Report of National Advisory Committee for Aeronautics, 1929, p. 13.

[12] Discussion of Problems Relating to Safety in Aviation by J. Sabatier, from Bulletin Technique, No. 42, of the Service Technique et Industrial de l'Aeronautique.

What constitutes an error in piloting? A spiral take-off certainly constitutes one. The case is not so clear, however, when, for example, the pilot, feeling his engine weaken, begins a turn, in order to avoid an obstacle which looms up in front of him. Should the consequent stall be ascribed to the faulty functioning of the engine, which was the original cause, simply because the pilot considered the fall less dangerous than the collision? The causes ascribed to such an accident will vary according to how this question is answered. It is the belief of the Commerce Department that the possibility of faulty analysis is ever present in accidents involving complications, erroneous or insufficient information, but that the mistakes that do occur will tend to counterbalance each other in a composite percentage table of all accidents.

Civil Accident Statistics for 1929 and 1930

Statistics are prepared for periods of six months. During the first half of 1929 the total number of accidents analyzed was 774. During the second half of the year, there were 924.[13] The Department of Commerce attributes this increase to three reasons:

1. The Department organization was operating with greater efficiency and was able to cover a greater number of the accidents that occurred.

2. Irresponsible operators are becoming lesser in number with the result that fewer accidents are unreported.

3. The amount of flying that has increased at a much greater rate than the number of accidents.[14]

[13] Air Commerce Bulletin, Vol. 2, No. 10, p. 253.
[14] *Aviation*, May 4, 1929, p. 1501.

Accident causation percentages for the first half of 1929 and 1930 present an instructive study:[15]

		1929 (1st half)	1930 (1st half)
Pilot	Error of judgment	12.79	11.35
	Poor technique	32.49	35.85
	Disobedience of orders	1.92	1.98
	Carelessness or negligence	9.57	6.08
	Miscellaneous	.54	.57
	Total Pilot Errors	57.31	55.83
Other Personnel	Supervisory	.25	.47
	Miscellaneous	1.48	.84
	Total Errors of Personnel	59.04	57.14
Power Plant	Fuel system	6.15	2.83
	Cooling system	.84	.53
	Ignition system	2.75	1.31
	Lubrication system	.35	.13
	Engine structure	1.68	8.37
	Propellers and accessories	.78	.23
	Engine control system	.06	.29
	Miscellaneous	.26	.40
	Undetermined	5.21	.93
	Total Power Plant Failures	18.08	15.02
Structural	Total structural failures	6.38	6.73
	Handling qualities	2.36	2.05
	Instruments	.06	...
	Total Materiel Failures in Airplane Structure	8.80	8.78
	Weather	5.02	6.52
	Darkness	.51	.09
	Airport and terrain	2.78	9.71
	Other	1.04	1.33
	Total Miscellaneous Causes	9.35	17.65
	Undetermined or doubtful	4.73	1.41

A very cursory examination of these statistics reveals many interesting and vital facts. It will be noted that the general division charges accident causation to five factors: Personnel, Power Plant, Structural, Miscellaneous, and Undetermined and Doubtful. Of spe-

[15] Air Commerce Bulletin, Vol. I, No. 14, p. 11.

cial interest is the preponderant percentage of accidents attributable to personnel and particularly to the operating pilot. Of even greater importance is the large percentage under the general division of "Errors of the Pilot" which is chargeable to "Poor Technique." Poor technique is described as "lack of skill, dexterity, or coordination of the senses in handling aircraft controls, whether traceable to inherent inability to attain such, or too infrequent flying, lack of experience in flying, lack of experience in flying under particular conditions, or in the particular type of aircraft."[16]

In commenting on the high percentage charged to "Poor Technique," Mr. E. P. Howard, Chief of the Air Regulations Division, said, "This, of course, reflects back on the pilot's original training."[17] The conclusion reached was that higher standards were needed in flying schools, and a further classification of the transport pilot should be immediately made restricting a pilot's activities to those types of aircraft he was familiar with. Both of these changes in regulation have been made. These two regulation changes, based on an analysis of the 1928 accident statistics, indicate the positive value of such statistics and the alertness of the Aeronautics Branch to take immediate advantage of their interpretation.

Other observations in respect to materiel show that the largest proportion of failures are chargeable to the power plant[18] and specifically the fuel[19] and ignition systems.[20] Structural failures are not of great importance, amounting to only 8.80 per cent of the total. The per-

[16] N. A. C. A. Report No. 308, p. 11.
[17] *Aviation,* May 4, 1929, p. 1502, 17-a. See chapter on "Functional Operation of the Air Regulations Division."
[18] 18.08% and 15.02% respectively for the first half of 1929 and 1930.
[19] 6.15% and 2.83% respectively for the first half of 1929 and 1930.
[20] 2.75% and 1.31% respectively for the first half of 1929 and 1930.

centages indicate that our present day planes are structurally sound, but require greater perfection in their power plants to insure a better degree of reliability. Of the miscellaneous causes of accidents weather[21] and airport and terrain[22] are the principal causes of accidents. The remedies are evident, improved weather systems and better surfacing of airports.

Accidents due to material failure have received careful attention. While the Department of Commerce only publishes the composite percentages on accidents, it must be remembered that the accident reports place the Department in a position to obtain exact information concerning structural failures of any make of aircraft, or accidents resulting from poor flying characteristics, such as spinning tendencies. It is the policy of the Department to take up such matters privately with the particular manufacturer concerned and to assist him in eliminating the difficulty. This procedure has already very definitely contributed to the production of better aircraft and is becoming one of the greatest contributing factors to the production of structurally sound aircraft and reliable engines.

In summarizing the accident causation percentages for the first half of 1930, it may be noted that about three-fifths of the accidents are due to man failure on the flying end, one-quarter to materiel failures, man failure on the manufacturing end. Only the remaining three-twentieths of the accidents can be charged to the weather and other factors over which man has no control with undetermined or doubtful causes included in this three-twentieths of 1.41 per cent.[23]

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[21] 5.02% and 6.52% respectively for the first half of 1929 and 1930.
[22] 2.78% and 9.71% respectively for the first half of 1929 and 1930.
[23] Also included are accidents due to airport and terrain, 2.78%.

Accidents classified as to kinds of flying engaged in at the time of the accident are:

Kind of Flying	1929 (1st half) per cent	fatal injury [24]	1930 (1st half) per cent	fatal injury [24]
Scheduled flying (airways) ..	7.75	18	4.73	27
Student instruction	10.34	21	22.04	23
Experimental	3.49	3	1.94	9
Miscellaneous flying	78.42	161	71.29	195
	100.00	203	100.00	254

It is significant to note that only 27 fatalities occurred in scheduled transport out of a total of 254 for the first half of 1930. Aircraft operating in scheduled transport are, almost without exception, licensed and piloted by transport pilots, the highest grade of license granted by the Department of Commerce. In addition, these planes are operated by responsible transport companies. The percentage of accident causation chargeable to scheduled transport in the first half of 1929 was 7.75 per cent, while the Department of Commerce statistics indicate that 17.60 per cent of the total flying in the United States was done in scheduled transport operations during that year.[25] It is in this type of flying that the Department of Commerce is able to exercise the greatest degree of supervision in enforcing its regulations. These statistics are perhaps the strongest argument for Federal regulation.

The highest percentage[26] of accidents occurred in miscellaneous flying where enforcement of the Federal regulation is very difficult, where a great number of the

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[24] Includes fatalities to pilots and passengers.

[25] 1929 estimates are airplane miles flown, scheduled transport, 22,000,000. Airplane miles flown non-scheduled transport, 125,000,000 miles.

[26] 1929, first half, 78.42%; 1930, first half, 71.29%.

accidents involve unlicensed planes, and where many of the licensed planes are operated by holders of the lower grades of Federal pilot licenses.[27] Based entirely upon personal observation of the varied types of flying classified as miscellaneous, which may consist of anything from "joy hops," aerial photography and "sky writing" to crop dusting and cross-country taxi service, the writer would conclude that there are several readily discernable factors which make this type of flying more hazardous than scheduled transport, namely:

1. The airplane equipment is generally less modern and the maintenance of such equipment less efficient and thorough.

2. The landing fields used do not approach the standards required of airports by scheduled transport operators.

3. Many of the pilots do not possess the experience demanded by scheduled transport operators.[28]

4. Much of the miscellaneous flying is done over unfamiliar country, whereas the scheduled transport pilot is familiar with his route.

5. Where operations are intrastate, the Federal requirements of licensed planes and pilots do not apply.

6. The higher sense of responsibility of the transport operators motivates them to exercise greater precaution in their operations.[29]

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[27] Limited Commercial, Industrial and Private licenses.

[28] The Limited Commercial pilot's license permits the holder to carry persons for hire on short rides about his home airport. The flying time required for this type of license is 50 hours of solo. Pleasure flying is also included under miscellaneous flying. For this type of flying no Federal license is required. Pilots employed by interstate transport operators must have a Federal Transport license.

[29] Transport operators are also more responsible financially than the operators of the miscellaneous services. They are consequently in a better financial position to provide more modern equipment and more aids to navigation. Transcontinental Air Transport operate their own weather and communication system over a part of their route.

All types of miscellaneous flying are generally performed with a lesser degree of skill and carefulness than the more carefully planned scheduled transport. Transport service demands the acme in pilot's skill, plane and motor reliability, ground facilities and aids to navigation. These factors of safety are also demanded by the Federal air commerce regulations. Practically all of the companies operating scheduled transport routes are even more exacting in their requirements than the Federal regulations compel them to be.[30]

The Human Factor in Accidents

The high percentage of accidents caused by errors of the pilot[31] is the most alarming phase of safety promotion work. It has consequently received much attention from those interested in commercial and military aviation. To what must we attribute the frequency of these errors in piloting? Must we believe that men are inferior to machines? Must we believe, on the contrary, that airplanes should be made more easy for the average man to operate? In the former case, the education of the pilot should be made more comprehensive and thorough. In the latter case, the quality and design of the airplane should be improved.[32] It is obvious that aviation could not develop very far if only men endowed with exceptional qualities could serve as pilots. The solution probably lies in both directions. We must seek an airplane that is less difficult to operate to diminish the dangers resulting from the failure of the human

[30] In the calendar year 1927, 6 pilots and 1 passenger were killed in scheduled flying out of a total of 164 fatalities in all flying.

[31] 57.31% in the first half of 1929.

[32] Most important of recent efforts in promoting the building of safer aircraft is the Safe Aircraft Competition conducted by the Harry F. Guggenheim Fund. For description see *Aero Digest,* December, 1929, p. 69.

organism.[33] Progress in this direction may eliminate the necessity for exceptional skill on the part of the pilot, but it appears that the selection, instruction and suitable training of pilot personnel will largely determine the safety of aviation. Mr. H. Brunat, who has studied the same problem in French aviation, arrives at a similar conclusion. In his report he states that 54 per cent of the accidents in French aviation were due to professional and piloting errors. "Although the development in aeronautical construction is marked every year by the creation of swifter aircraft which carry heavier loads and have a longer radius of action, thus calling for a steadily increasing professional knowledge on the part of the crew, the methods of enlisting pilots have not changed since the war. Upon close examination, it appears that the previous instruction of most of our student pilots has been quite inadequate, so that they are unable to acquire the necessary professional and technical knowledge for safely piloting modern aircraft, particularly commercial airplanes and seacraft."[34] The problem of adequately training pilot personnel is receiving considerable attention in the United States. The immediate future of successful flight training is very promising. Many of the more progressive commercial schools are vigorously attacking the entire problem.[35] The Bingham amendment providing for Federal rating of com-

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[33] The Handley-Page slotted wing and the Pitcairn Auto-giro are examples of serious attempts to produce a fool-proof airplane. Description of Auto-giro is contained in *Aero Digest,* October, 1929, p. 124.

[34] Safety in Airplane Flight, communication by H. Brunat of the Service de la Navigation Aerienne of the Société Française de Navigation Aerienne, November 10, 1926.

[35] Colonel Charles A. Lindbergh in a paper, "Requirements and Training for a Commercial Pilot," report of the First National Aeronautical Safety Conference, p. 720, states that flying training may be advanced "by a definite standard of flying instruction, State adoption of Federal flying regulations, development of commercial training planes, and suitable location of training field."

mercial schools has been a great incentive for the schools to improve their methods of instruction. It appears quite probable that by the end of 1931 the best commercial schools in the world will be located in the United States.

Experience of the Pilot as a Safety Factor

Many lessons are learned through individual experience. As a method of teaching aviation, experience is not to be preferred over organized instruction because of its costliness in human lives. Statistics are available from two sources which indicate that the extent of a pilot's experience has a direct relationship to his chances of escaping accidents. The annual report of the Chief of the Air Corps contains the statement that pilots who fly 50 to 100 hours yearly run only half the chance of an accident as do those whose flying hours are less than 50 hours each twelve months.[36] The accident statistics of the Commerce Department for the first half of 1928 show that out of a total of 390 accidents, 76 involved pilots with less than 50 hours flying time; 21 involved pilots having between 50 and 100 hours; 17 involved pilots having between 100 and 150 hours; 20 involved pilots having between 150 to 200 hours, and 13 having between 200 and 250 hours. In addition to these statistics, Mr. E. P. Howard, of the Air Regulations Division, states that, "A study of the records of the pilots who have been killed show that they are apt to have a series of minor accidents preceding the fatal one."[37]

These statistics are even more significant when it is considered that 62.4 per cent[38] of the licensed pilots

[36] Statistics of Navy Department on crashes per 1000 hours of flying time for years 1921 to 1927 are contained in *Aviation,* February 16, 1929, p. 473, et. seq.

[37] Interview with Mr. E. P. Howard, August 24, 1929.

[38] *Aviation,* May 4, 1929, p. 1503, Percentage as of January 1, 1929.

were holders of the transport license.[39] They serve also as additional evidence that the instruction period is the most dangerous stage of becoming a pilot. The number of accidents occurring to pilots having between 50 and 100 hours' flying time might suggest further revision of pilot license requirements. With 50 hours of solo flying a pilot is qualified to secure a limited commercial license. This type of license permits him to carry passengers for hire within the area designated in his license. While this provision allows the limited commercial pilot to receive some remuneration during the time he is attaining sufficient hours in the air to qualify for the transport license, there is considerable doubt in the mind of the author as to the advisability of this provision from the point of view of safety.[40]

Carelessness and Stunting

A recent editorial contains the following statement: "Persistent efforts are being made to increase the safety of air travel, and because they have been successful in a general way, recent airplane accidents, nearly all the result of recklessness, seem doubly deplorable. For unless the man on the ground clearly realizes that these accidents were avoidable, he will inevitably feel that all flying is unsafe. To the extent that such an impression prevails the progress of American aviation will be hindered. . . . Federal regulations laid down and enforced by the Department of Commerce provide every reasonable safeguard for passengers travelling on the regular airways. . . . The record of the last six or eight years shows beyond all doubt that where these rules have been strictly followed there was less likelihood of accidents

[39] The Transport license requires 200 hours of flying time.

[40] If the State does not require a state or federal license, such flying would be legal without a license.

in the air than in ground transportation. With rare exceptions all of the accidents occur when the machines are flown by amateur pilots or where there is a gross violation of the rules governing flying. Every avoidable accident suggests a need for a still stricter enforcement of the prescribed regulations."[a] Another editorial expresses the same idea in a different way: "National Air Transport planes have flown 1,116,211 miles without the slightest injury of any kind to a passenger, or the loss of a single ounce of mail or express since the beginning of operations, May 12, 1926. Take transcontinental mileage, a distance equal to more than 132 times around the earth at the equator, was flown on regular routes, over half of it during the night, through all kinds of weather. In this flying there was no stunt flying of any nature whatsoever. The pilots and the ground crews are responsible for this fine record."[b] In 1927, Lieutenant Donald Duke, then chief of the Airways Bureau of the United States Army, made the comment: "The failure of attempted freakish aircraft performances, wherein both engineering standards and common sense are sacrificed by so-called 'crack pilots' for publicity stunts, have no more bearing on aviation's true mission than has one of Will Rogers' comedy diplomatic feats on our national jurisprudence."[c] The above excerpts have been inserted to indicate the general attitude toward stunting and recklessness.

It is impossible to scientifically determine the percentage of accidents that are attributable to stunting and

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[a] Pennsylvania Evening Public Ledger, April 21, 1930.

[b] Aero Digest, November, 1929, p. 347.

[c] The Annals of the American Academy of Political and Social Science, May, 1927, p. 161.

[d] Mr. Walter F. Brown, President of the Transcontinental Air Co., has stated that it is the policy of his company to refuse to take part in aerobatic demonstrations. Aviation, June 15, 1929, p. 1677.

inexperience because of the tendency of the commercial pilots to attribute all of his accidents to causes other than his own inexperience, carelessness, or reckless flying. If the pilot survives the crash, he quickly prepares an alibi that will justify himself with his employer and with the Department of Commerce inspector who investigates the accident. Mr. Donald E. Keyhoe, formerly of the Aeronautics Branch, cites various accidents giving the printed newspaper cause and the real cause of each accident. He has selected a few cases at random from the 1400 accidents analyzed by the Accident Board with these results:[45]

1. Printed cause: Plane mysteriously out of control, perhaps jammed controls.
   Real cause: Inexperience, lack of instruction in acrobatics, and carelessness in experimenting at a low altitude.
2. Printed cause: The engine seemed to falter.
   Real cause: Poor flying ability.
3. Printed cause: A steep dive.
   Real cause: Forgetfulness or carelessness.
4. Printed cause: Strain from looping.
   Real cause: Defective repairs.

Colonel Charles A. Lindbergh reiterates, "Nothing so annoys the pilot who has devoted his life to aviation, and who wishes to build up in the public mind confidence in aircraft, as foolish flying. It is criminal for careless and ignorant pilots to take up passengers. The average person knows nothing of airplanes or pilots, and will often entrust his life to a pilot who has no right to fly anyone but himself. When a passenger is killed in such circumstances, it is very seldom that anyone but other

[45] *The Saturday Evening Post,* October 5, 1929, p. 10, et seq.

pilots realize that it was inexperience or recklessness which caused the crash."[46]

What psychological process would induce a prominent Congressman to fly so close to the tops of Washington buildings that it was necessary for the War Department to formally reprove his action?[47] What state of mind compelled a pilot to swoop to the surface of a lake in an effort to frighten a man in a boat and resulting in the death of the pilot and one passenger?[48] Why did a prominent pilot attempt to fly a plane when he was so much under the influence of liquor that his attempt resulted in the loss of his own life and the lives of his two passengers?[49] What mental process would cause a pilot to kill himself and one passenger by recklessly diving a light commercial plane for 5000 feet and subjecting it to such excessive strain that a wing was torn off?[50] The most distressing feature of each of the above questions is that they describe actual accidents. The Air Commerce Regulations are sufficiently broad in their scope to suspend or revoke the license of pilots who fly while under the influence of liquor, who violate the air traffic rules, who operate aircraft with carelessness or inattention to duty, or who do any act with aircraft "which is contrary to the public safety or interest."[51] Those federally licensed pilots who persist in engaging in reckless flying should be dealt with as severely as the Air Commerce Regulations will allow. It is of equal importance that the individual states pass legislation that will penalize intrastate reckless flying.

The writer is not assuming that it is possible to

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[46] *New York Times,* November 4, 1928, p. 12.
[47] *New York Times,* May 31, 1929.
[48] *Philadelphia Evening Ledger,* August 15, 1928.
[49] *Chicago American,* July 5, 1929.
[50] *Washington Evening Star,* August 26, 1929.
[51] Air Commerce Regulations, Section 62.

eliminate all stunt and experimental flying. Without it there would be little further progress in aviation development. Trial and error, even at the cost of human life, is the only method by which the art can be advanced. But it cannot be too strongly emphasized that the risks of experiment must be assumed by those to whom the advancement of the art is a career. Experiment cannot be permitted where passengers are involved.[52] Prudence is still the better part of valor. Sensing danger and forestalling it, whether it be in connection with the plane, the weather, the terrain or the public, is a psychological attitude clamoring for cultivation. The commercial pilot who is to instill confidence in the public must impose upon himself the strictest inhibitions, and repress all desires to demonstrate what the plane or himself is capable of in the way of hair-raising thrills.

The Problem of Safety in Scheduled Transport

The public is gradually being educated to expect that accidents will occur in miscellaneous flying or non-scheduled operations. It will not accept, without seriously impairing confidence, very many accidents in scheduled transport operations where the public assumes that all safety precautions have been taken. The transport companies must therefore take upon themselves the added burden of maintaining public confidence by conducting their flights in the most careful and meticulous methods known to aviation experience. One fatal accident in scheduled transport will do more damage in shaking public confidence than a series of accidents in non-scheduled flying. Since other modes of transportation are still taking their yearly toll of deaths and injuries it is not

[52] The Federal Air Traffic Rules forbid the acrobatic flying of any plane carrying passengers for hire. Air Commerce Regulations, Section 72-2-d.

to be expected that air transportation will establish a faultless record in that respect. Accidents will occur in scheduled transport. They will receive exaggerated publicity on the front pages of our newspapers just as the railroads and the automobile accidents did when those modes of transportation were new and untried.[53] Any fatal airplane accident possesses news value of a national character. Automobile fatalities have been relegated to the local interest classification of news value. Despite newspaper publicity it is difficult to overlook the Department of Commerce statistics on fatalities per mileage flown. In comparing the first six months of 1929 with the first six months of 1930, these statistics show a total of 1,022,371 miles flown per fatality for the former, and 2,817,121 miles flown per fatality for the latter period in scheduled transport.[54] Contrasting these figures with those for miscellaneous flying a strong argument is presented for the safety of scheduled transport. Assistant Secretary Young, of the Aeronautics Branch, reported one fatality per 398,305 miles flown in miscellaneous flying during the first six months of 1929 and 359,494 miles flown per fatality during the first six-month period of 1930.[55]

The outstanding requirement for safety in scheduled transport has been defined by Colonel Paul Henderson as "hard work."[56] "This hard work is made up of a multiple of details. Some few of those details are interesting and obvious to the layman. The great number, however, are uninteresting and may be catalogued as drudgery. . . . There are only two kinds

[53] For an interesting discussion of this problem, see "Aviation and the Newspapers," by John Goldstrom, *U. S. Air Service,* October, 1929, p. 46.

[54] Air Commerce Bulletin, Vol. 2, No. 10, p. 255.

[55] *Ibid.*

[56] Report of the First National Safety Conference, p. 659.

of airplanes: Those in first class condition and those in bad condition. There are no airplanes in fairly good condition. Those that might be classed as fairly good, must, from the point of view of air transport, be catalogued as unserviceable. As a consequence every little adjustment, every bolt and nut, every piece of fabric, every valve, valve spring, every bearing, every turnbuckle on an airplane must be exactly right before a scheduled trip is undertaken." Colonel Henderson has only stated that the responsibility of operating scheduled transport planes requires the operators to maintain their equipment in the most efficient manner possible. This principle is not new. It is well recognized as a fundamental, and yet there are some operators of air lines in the United States not inspecting and maintaining their planes in accordance with the most modern and recognized practices. This condition cannot be glossed over. If it is overlooked, it is because the necessity of keeping the planes and engines in absolutely flawless condition and making frequent inspections of every detail is so obvious.

As larger and more powerful airplanes are developed seeking for safety and reliability in greater structural strength and mightier engines there is great temptation for operators and pilots to maintain schedules in the face of adverse weather conditions. Fog and storm are still dangerous factors to safe transport whether that transport be attempted through the mediums of the airplane, the railroad, or the automobile. A high percentage of trips completed for those scheduled is commendable only if it has been accomplished safely. Weather services and adequate communication have made it possible to know in advance meteorological conditions along the entire route to be flown. The placing

of responsiblity for deciding whether or not a flight should be made has long been a controversial point in both military and commercial flying. Despite improved ground organization and the increased experience of field managers, the trend has been distinctly toward concentrating responsibility in the pilot and placing all dependence upon his judgment. The soundness of this trend seems questionable. If it becomes the accepted practice the pilots should be constantly impressed with the necessity of precaution, and of landing or turning back when safety becomes doubtful.

During the winter of 1929-30, air transport operators experienced the effects of strong competition for business. The result was the appreciable lowering of rates.[57] In some instances, operators launched competitive services without adequate survey of routes, ground organization, or financial backing. The writer strongly feels that the operator who will not utilize all of the known safeguards in his transport service should be barred from offering such services to the public in direct competition with operators who are willing and financially able to employ all of the adjuncts to safe transport operation. It is just as reasonable for the Government to restrict the carrying of passengers over routes not equipped at the present standards, as for them to require certain standards to be complied with in the competency of pilots and the airworthiness of aircraft.

Responsible operators have a right to some such protection against unfair competition. Especially have they the right to be protected from irresponsible competition which manifests itself only at those times when

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[57] For a schedule of some of the reductions see *Aviation,* January 25, 1930, p. 177.

there is cream to be skimmed from the market. Rivals who fly only when weather conditions are good and under peak load conditions that will insure them a minimum overhead. The issuance of a permit or a certificate of necessity and convenience would insure minimum safety standards and would prevent the penalizing of the operators who maintain such minimum safety standards. Such a plan would have the added advantage of placing all operators on an equal footing in respect to rate competition. Rate regulation by a governmental agency does not seem advisable during the formative stage of air transport.[58] Potential competition and the necessity of building up a traffic in the face of the established means of surface transport offer better assurance against excessive rates than anything that a governmental agency could undertake.

These suggestions will be carried out during the year 1930.[59] In January, 1930, the preparation of minimum requirements was undertaken by the Department of Commerce in coöperation with air transport organizations. The added regulations will compel passenger transport companies to fully utilize all air navigation facilities in their operations. These facilities include two-way radio facilities aboard the planes for the reception of frequent broadcasts of weather information, emergency messages, the transmission of inquiries to ground organizations for the proper guidance of the plane, and also for the reception of signals from available radio range beacons. The regulations will further

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[58] The Aeronautical Chamber of Commerce, The National Aeronautic Association, The Guggenheim Fund for the Promotion of Aeronautics and the American Bar Association are in agreement on this question. See *Aviation,* November 30, 1929, p. 1065.

[59] Mr. Harry F. Guggenheim offers seven "commandments" to accomplish safety in scheduled transport. See *Philadelphia Evening Bulletin,* August 8, 1929, p. 14.

require that passenger transport routes be provided with a sufficient number of intermediate landing fields properly equipped for use in case the flight is interrupted, adequate airports, proper communication and weather reporting services, adequate night flying facilities for passenger operations after dark, including airways lighted with beacon lights and properly lighted airports and intermediate fields and also the equipment of the planes themselves with navigation lights and suitable lights for landing after dark.

Concerning these regulations, Mr. Clarence M. Young, Assistant Secretary of Commerce for Aeronautics, says, "Greater safety and reliability, increased use of air transportation by the public and further development of air commerce and the aircraft industry undoubtedly will result from strict adherence to these requirements, I firmly believe."[60]

The Department of Commerce has already supplied many of the airways with aids to navigation. It has erected beacon lights, established intermediate fields, issued airway maps for the guidance of pilots, provided radio range beacons, and radio communications. The establishment of these aids is undertaken and completed as fast as authorization and appropriations are available. The prescribing of ground facilities for passenger transport routes will practically have the effect of limiting such routes to those airways where the Federal Government has provided the required aids to navigation. If the Government has not provided the facilities, such as lighted airways, radio communication, radio beacons and weather reports, then the transport organization itself must take the necessary steps or await the Gov-

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[60] *United States Daily,* January 30, 1930, p. 1.

ernment's ability to provide them in the course of its airway development program.

Since the operator of an airline has no natural monopoly and his highways are free to all who care to use them, it is most probable that there will not be any appreciable number of transport organizations who attempt to supply their own aids to navigation.[61] The cost of construction and maintenance of these aids also makes it highly improbable that very many transport operators would be able to carry the overhead. While this will act as a check upon the expansion of transport operations, the regulative requirement of the full utilization of the air navigation facilities will compensate in safety for any retardation that might be experienced in the development of new routes.

Summary

The Federal regulation and promotion of aeronautics has for its chief goal the attainment of increased safety. The minute study and analysis of aviation accidents serves as the guide for the future trend of Federal aviation activities as well as a yardstick for existing regulations. Because of the indispensable nature of accurate and detailed statistics of all accidents, the author believes that Congress should make more liberal appropriations for accident investigation and analysis work. Such increased appropriations would permit:

1. An increased number of inspectors for field investigation of accidents making possible the more detailed and comprehensive study of each accident at the point of occurrence.

2. Additional personnel in the Statistics and Dis-

[61] Exceptions may be noted in respect to the Transcontinental Air Transport Company and the Boeing System.

tribution Section to engage in research on the entire problem of perfecting accident investigation procedure, analysis and statistical methods.

3. A greater personnel in the Medical Section to make a comprehensive study of the relation of the pilot's physical condition to his ability to safely handle aircraft.

The airplane of today is a safe method of transport if it is efficiently piloted. The same conclusion might be drawn for the automobile. It is, however, much more necessary for the airplane pilot to be efficient than the automobile operator because of the greater seriousness of an aircraft accident. Errors of the pilot cause 55.83 per cent of all aviation accidents. Of this total 35.85 per cent is chargeable to poor technique,[62] described as a "lack of skill, dexterity, or coördination of the senses in handling aircraft controls."[63] The accident statistics do not indicate what percentage of the accidents now chargeable to errors of judgment and poor technique might be charged to carelessness, negligence or inattention to duty. It is obvious that an erring pilot will attempt to escape such classification. The solution probably lies in two factors:

1. A more intensive study of the problem of flight training in respect to physical requirements, mental adaptability for flying instruction, teaching methods and the course of study.

2. The development of a psychology of safety among pilots. Frank A. Tichenor most aptly states the problem when he says "the cost of a crashed plane is nothing by comparison with the loss of public confidence which a crash is sure to cause. A very large proportion

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[62] Statistics are for the first half of 1930.
[63] N. A. C. A. Report No. 318, p. 11.

of such losses in the industry can be eliminated if the present crazy rivalry for speed and breaking records of one kind or another can be substituted by a rivalry for safety. It must stop or the final victim will be the industry itself."[64] Safety psychology has been developed to a marked degree in railway engineers and the officers of our merchant ships. An intensive campaign will be equally successful with our airplane pilots.

[64] *Aero Digest,* February, 1930, p. 66.

IX

STATE LEGISLATION

Previous to the passage of the Air Commerce Act of 1926, the Joint Committee on Civil Aviation of the Department of Commerce and the American Engineering Council conducted an inquiry into the aviation industry in the United States. In view of the amazing mass of aeronautical legislation enacted by the various states,[1] the following excerpt from the Committee's report is of special interest: "While it is true that the air space at the present time is not crowded by privately owned aircraft, there are indications of a steady growth in this direction. All are agreed that when congestion actually occurs the only agency that can effectively cope with the situation is the Federal Government. If this be true it seems unwise for the State Governments to complicate matters by exercising such regulatory jurisdiction as the Federal Government leaves open to them. Not only will confusion result from a dual exercise of regulatory powers, but once the states exercise jurisdiction over aircraft it will be much more difficult to pass a Federal law which would supersede the state regulations."[2] The Committee then recommended that Congress assume the regulation of all air commerce as the only reasonable method of protecting interstate and foreign air commerce.[3]

[1] Legal and Legislative Bulletin No. 6 of the A. C. of C. reports 314 individual bills were introduced in the state legislatures in 1928-29.

[2] Civil Aviation, A Report by the Joint Committee on Civil Aviation of the Department of Commerce and the American Engineering Council, 1925, p. 120.

[3] *Ibid.*, p. 120.

The Federal Government has not assumed such sweeping regulative authority as was recommended by the Joint Committee on Civil Aviation. Under the provisions of the Air Commerce Act of 1926, the Department of Commerce can impose licensing requirements only upon aircraft and airmen who are engaged in commercial[4] flight originating in one state[5] and terminating in another state, or else originating and terminating in the same state, but passing through the airspace over any place outside thereof. Licensing provisions of the Federal law do not apply mandatorily to aircraft engaged in non-commercial or pleasure flying or to commercial flying of an intrastate nature.[6] The provisions of the Federal act have the effect of confining the operations of unlicensed commercial aircraft to the borders of those respective states in which there are no limiting state laws. Due to the limitations on Federal licensing authority it is imperative that every one of the 48 states enact suitable assisting state legislation requiring the employment of airworthy aircraft and competent pilotage by those companies that are engaged solely in intrastate flying.[7] Unprecedented state legislative activity has occurred in this regulative field.

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[4] Commercial navigation is defined by Section 1 of the Air Commerce Act as "transportation in whole or in part by aircraft of persons or property for hire, navigation of an aircraft in furtherance of a business, or navigation of aircraft from one place to another for operation in the conduct of a business.

[5] Corresponding provisions are in force in respect of flight originating or terminating in the Territories or possessions, or the District of Columbia.

[6] Many writers have advocated exclusive national legislation. See (Brief of Major Johnson, counsel to Director United States Air Service, p. 29; Kuhn, 14 Am. J. Int. L., 369, 381; Zollman, Governmental Control of Aircraft, 53 D; Am. L. R., 897 (1919); Report of Committee on Legislation, Manufacturers Aircraft Association, September 15, 1919.)

[7] Assistant Secretary Clarence M. Young of the Commerce Department has stated that, "Until there is concerted uniform action by all the states, effective regulation of all aircraft is impossible." *Aero Digest*, June, 1928, p. 929.

Mr. Rowland W. Fixel, an authority on aviation law, is firmly convinced that Congress will eventually have to take control of all matters pertaining to the operation of aircraft in the United States. He believes that a division of control between the Federal Government and the states would injuriously react on the further development of the aviation industry. "There must be central control of aviation due to (a) the possibilities of so-called intrastate aerial navigation interfering with nationally controlled aviation; (b) the inability to determine boundary lines in the air; (c) the necessity for control of entry of foreign aircraft by the Federal Government; (d) the international character of aviation; (e) the ease of bootlegging aliens to the country; (f) the necessity for uniform registration, inspecting and licensing as a protection to the public using aircraft. In fact, all interferences by the state should be eliminated, except such as associated with police powers over landing fields and purely local aspects of the art or industry."[8]

Organized Efforts to Foster Uniformity of State Legislation

The vital necessity of uniformity of state legislation to avoid confusion was early anticipated by the Department of Commerce and other organizations interested in the development of aviation. When it is considered that 47 of the states[9] have now enacted some form of legislation pertaining to aeronautics, that 42 of the state legislatures introduced 314 bills, 182 of which were enacted and 132 defeated during the 1928-29 sessions alone, it is remarkable that the general effect of these

[8] "Control of Air Transportation," R. W. Fixel, *Popular Aviation,* January, 1928, v. 81.

[9] Alabama has no aeronautical legislation.

statutes did not produce a more chaotic condition. Much of the credit for these results may be attributed to the efforts of the Department of Commerce, the National Conference of Commissioners on Uniform State Laws, the Committee on Aeronautical Law of the American Bar Association, and the boards and advisory commissions in the various states.

Of all the proposed legislation concerning the licensing of airmen and aircraft by the states, the Department of Commerce Draft and the American Bar Association Draft may be considered as characteristic. Both drafts have as their objective the promotion of uniform state legislation for the licensing of aircraft and airmen. There are two principal points of difference.

1. The Department of Commerce Draft requires no state agency of administration other than the peace officers of the state, while the American Bar Association Draft would require either the creation of a new agency of administration or the employment of an existing agency[10] to carry out the provisions of the draft.

2. The Department of Commerce Draft requires a Federal license for all pilots and aircraft operating within the state, while the American Bar Association Draft would make optional either the Federal license or a license issued by the state.[11]

The attitude of the Department of Commerce toward the two drafts is clearly stated in Aeronautics Bulletin No. 18, September 1, 1929. "The remedy, under the existing Federal law, requires suitable state legislation—legislation which, among other things, must take into consideration the imperative need for uni-

[10] The Highways or Motor Vehicle Department has been suggested as the agency to carry out the administration of the proposed law.

[11] Note that this conflict does not affect interstate commercial flight, which is under Federal control, but only non-commercial interstate and intrastate flying.

formity throughout the United States, in the matter of airworthiness of aircraft, competency of airmen, and most particularly, in the operation of aircraft in the air. Once an aircraft is in the air there can be no distinction between its interstate or intrastate character. It must be equally airworthy, the pilot must be equally competent, and the same rules as to passing, crossing, signaling, landing, etc., must be rigidly observed. Inasmuch as there can be but one standard of airworthiness, only a limited range of piloting ability, and no variation in rules, then it would seem obvious that State laws dealing with regulation should provide requirements identical with those of the Federal law. There are apparently several ways in which the required uniformity may be accomplished. The simplest way seems to be the enactment of a State law which would, in its effect, require all intrastate aircraft and airmen to be federally licensed. This at once sets up the identical requirements and obviates the necessity of a State inspection system with its attendant difficulties, complications, and expense.

"An alternative method is to provide for either State or Federal licensing, the former setting up identical qualification requirements; that is, intrastate aircraft and airmen not licensed by the Department of Commerce must obtain State licenses. On first examination this arrangement would appear to be quite satisfactory—that because the Federal licenses permit interstate operation and are thus broader in scope, they would in all cases be preferred, and the State thus avoid the necessity of issuing licenses. Experience has indicated that it is of doubtful satisfaction. The State, as a matter of fact, will be called upon to at least be prepared to issue licenses. And, unfortunately, many of the applicants will be those who have failed to qualify for the Federal

licenses. Presumably, such applicants will either possess unairworthy aircraft, or not yet have become sufficiently proficient in piloting, depending upon the nature of the license applied for. The State inspectors will then be required to pass upon the same aircraft or airmen and arrive at independent conclusions. They may or may not concur with the previous disposition of the cases by the Federal representatives, particularly in the light of local influence which may be brought to bear, and there is at once manifest the absence of one of the most needed elements—that of uniformity throughout the United States."[12]

The arguments advanced in the above excerpt for the Department of Commerce Draft are undeniably strong ones. The Department of Commerce has made painstaking efforts to develop and organize its inspection system. The task has been difficult and expensive. It requires specially trained personnel to insure competence in handling all the requirements involved. The requirements imposed by the Federal regulations are only the minimum consistent with safety. Any state could easily legislate to the disadvantage of aviation, penalizing it to the extent that it would avoid the state, if possible. The Department of Commerce believes that control and regulation have been accomplished in a fairly successful way by the Federal agency and that the Federal requirements and personnel should be taken advantage of to the fullest extent by all of the States of the Union.[13] The Department is of the firm conviction that the State enforcement of Federal requirements is the most feasible method of insuring uniformity among the states.[14]

That the conclusions and policies of the Depart-

[12] Aeronautics Bulletin No. 18, p. 1, et seq.
[13] *Ibid.*, p. 1.
[14] *Ibid.*, p. 3.

ment of Commerce in respect to state legislation has not been completely accepted is quite evident by the report of the Standing Committee on Air Law to the American Bar Association:

"Inspection of aircraft and airmen is still so much in the experimental stage that it is of the greatest importance that inspections throughout the country shall be uniform and flexible. It is most undesirable that states should set up statutory criteria of airworthiness, whether by direct legislation or by administrative interpretations, which shall materially differ from those existing in other states and enforced by the Department of Commerce of the Federal Government.

"It was suggested that the proper course would be to enact a simple statute making it a misdemeanor, punishable by fine and imprisonment, for any person within a state to fly an aeroplane unless that aeroplane and the person flying it were licensed under federal law.

"Your committee, after careful consideration of this proposal, concluded that such a law would not be satisfactory. There is some question as to the possibility of defining a state crime by reference to a federal statute and federal regulations alone.[15] The greatest obstacle, however, was a disinclination that would undoubtedly arise in many states to relinquish all control over intrastate aviation into the hands of the Federal Government. * * * At the same time your committee was desirout that any state legislation should not only harmonize in every particular possible with the Federal legislation, but should give recognition and encouragement to the licensing of aircraft and airmen by the Federal Government."

Opposition to the Department of Commerce Draft

[15] To circumvent this objection the Department of Commerce has submitted an optional draft which will be equally effective in carrying out their policies. See Aeronautics Bulletin No. 18, p. 5, et seq.

and a defense of the American Bar Association Draft was presented from a different point of view by Mr. Chester W. Cuthell in an address before the Annual Meeting of the New York State Bar Association:[16]

"Our own State (New York) last year enacted a law which makes it a misdemeanor punishable in our State courts for flight by any pilot or plane not holding a Federal license.[17] So far this law has not been attacked, but it seems to me that it might well be attacked on the ground that the State is surrendering its control over intrastate commerce and that the Federal Government, being one of limited powers, has no power to regulate purely intrastate commerce.

"But quite apart from the question of constitutionality, it seems to me wise and in accord with the repeated advice of all of our recent Presidents that detailed administrative matters be dealt with by the States rather than by the Federal Government. Perhaps the analogy to automobile licensing and registration is not quite fair, but I think you will all agree with me that it would be most unwise to attempt to license all of the chauffeurs and automobiles from Washington or by officials reporting to a Washington Department. The automobile is a highly mobile instrument which might and frequently does cross State boundaries in interstate commerce. Of course, there are many more automobiles than airplanes, but there is a far greater need for the constant examination of the fitness of pilots and the airworthiness of the airplanes."

The writer partially agrees with the sentiments expressed by Mr. C. W. Cuthell. When it is considered that an airplane, flying from Washington to New York

[16] Reported in *Air Law Review*, January, 1930, p. 89.

[17] The New York law follows the essential provisions of the Department of Commerce Draft.

in a little over two hours, might pass over five different States, it would seem that any analogy with automobile operation is quite unfair.[18] That Mr. C. W. Cuthell is a firm exponent of the "States Rights Doctrine" is obvious. It would seem that much of the strength of Mr. Cuthell's argument for state regulation could be nullified if the Department of Commerce would provide for decentralized administration of all the detailed regulative provisions such as the licensing of pilots and aircraft, the approval of aircraft and engines for the approved type certificate, the rating of flying schools and airports, etc.[19]

Suggested Agency for the Enforcement of the Bar Association Draft

In the report of the Standing Committee on Air Law to the American Bar Association, it was suggested that the "Superintendent of Motor Vehicles be the officer designated to carry out the law. In this way there has been avoided the necessity of creating a separate office. For the time being the work should be comparatively light and for the most part clerical, although naturally the increase in aviation will demand increase in inspection service."

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[18] In an address before the Western States Air Commerce and Airways Conference, Governor I. L. Patterson of Oregon said: "The Governor of Idaho spoke about an organization, this organization being, we hope, one unit of a national organization of all the states. It seems to me that that is what must come about. *Naturally, the airplane, more than any other craft or mode of transportation, will be interstate.* The Federal Government will no doubt be more interested, and there will be more legislation and more regulations than for any other kind of transportation." For report of this conference consult State of Idaho, Department of Public Works, Aeronautics Bulletin No. 3.

[19] Such decentralization has been recommended in a previous chapter. As a first step toward such a status, the Department of Commerce has already made provision for the renewal of pilots' licenses by Field Inspectors of the Department. See *Philadelphia Evening Public Ledger,* February 8, 1930.

This recommendation has been severely criticized by Professor Talbot Freeman of the National Aeronautics Association. He believes that such an administrative agency is not practical and cites the experience of Connecticut. "Their first law was passed shortly after the war. It was amended in 1921, 1923 and 1925, each time being strengthened to care for unforeseen problems. As a result, the law is now a castiron code with no flexibility, and Connecticut will find it more difficult to change the law into a more practical, workable law than it was to enact it in the first place. One good thing that was accomplished was the separation of the Aviation Department from the Motor Vehicle Bureau in 1925, and since then the aeronautics officials have found it much easier to administer their duties."[20] In concluding his paper, Mr. Freeman urged that state legislation should be, first of all, uniform, and second, flexible enough so that problems arising from time to time might be handled by regulations rather than by the provisions of the laws themselves. The necessity of flexibility of regulations has been most certainly demonstrated by the experiences of the Department of Commerce. It might be assumed that the same necessity exists in respect to state legislation. If this be true, it would follow that regulations embodying suitability and efficiency could only be promulgated by an agency possessing specialized aeronautical training and knowledge. If it is the intention of a state legislature to exercise its authority over intrastate commerce to the extent of requiring state licenses for pilots and aircraft, it should be prepared to supply efficient administration by aeronautical experts, adequate clerical

[20] A resumé of Mr. Talbot Freeman's paper as presented in The Report of the Western States Air Commerce and Airways Conference, State of Idaho, Department of Public Works, Aeronautics Bulletin No. 3, p. 28.

personnel, a corps of field inspectors, and all of the other adjuncts of a successful licensing system. Such a system would impose a heavy financial burden upon the state.

Present Status of State Licensing Requirements

An analysis of the various types of state licensing requirements for intrastate operation is indicative of the lack of uniformity of such state legislation.[21] The conflict in state licensing requirements is regrettable and will most probably have a retarding influence upon the aviation industry. The most detrimental factor to greater success in securing uniformity is the failure of the two principal agencies working for such uniformity to arrive at a common solution of the problem. Both agree that uniformity is highly desirable and necessary to aeronautic development, but the one agency[22] believes that the requirement of a Federal license is the advisable type of state legislation, while the second agency[23] is convinced that each state should set up its own administrative organization for granting state licenses. If authoritative agencies, national in viewpoint and employing intensive research methods, arrive at varying conclusions, it is not surprising that the legislative attempts of the states have resulted in lack of uniformity.

The forty-eight states and the United States Territories may be classified into five groups with reference to their respective legislative licensing requirements for aircraft and airmen:

1. Those states and territories requiring, by statute, Federal licenses for all aircraft and airmen flying within their jurisdiction.

[21] For the full text of state legislation consult United States Aviation Reports, 1929. For an excellent resumé see Department of Commerce, Aeronautics Bulletin No. 18, September 1, 1929.

[22] The Department of Commerce.

[23] The American Bar Association.

Arizona[24]
California
Idaho
Indiana
Iowa
Kentucky
Maryland
Michigan
Mississippi
Missouri
Montana
New Mexico
North Dakota
Rhode Island
South Carolina
South Dakota
Texas
Vermont
Washington
Wisconsin
Wyoming
Alaska

2. Those states and territories requiring, by statute, Federal licenses only for those aircraft and airmen engaged in commercial flying within their jurisdiction.

Colorado[25]
Illinois
Nebraska
New Jersey
New York
Nevada
North Carolina
Ohio
West Virginia
District of Columbia
Hawaii
Philippine Islands
Porto Rico

3. Those states requiring, by statute, either state or Federal licenses for all aircraft and airmen flying within their jurisdiction.

Delaware
Maine
Minnesota
New Hampshire
Oregon
Virginia

[24] The Air Commerce Act of 1926 applied to the District of Columbia and all territories; Alaska and Hawaii have supplementary territorial acts.

[25] Note 24, supra, also applies to this classification.

4. Those states requiring, by statute, state licenses for all aircraft and airmen flying within their jurisdiction.

Arkansas	Kansas
Connecticut	Massachusetts
Florida	Pennsylvania

5. Those states having no aeronautical legislation requiring licenses for aircraft and airmen flying within their jurisdiction.

Alabama	Oklahoma
Georgia	Tennessee
Louisiana	Utah

The above tabulation indicates that the legislative licensing requirements of twenty of the states, exclusive of the territories, conforms in theory with the Department of Commerce Draft. Six of the states conform in theory with the Bar Association Draft. Six states declare by legislative enactment that intrastate flight of whatever description is unlawful unless both craft and pilot are licensed under the state law. Six states are listed above as having no aeronautical legislation requiring licensing of aircraft or airmen. It might be noted that Federal licenses are required for aircraft and airmen engaged in commercial flying in Nevada not by legislative enactment but by order of the Public Service Commission of that state.[26]

Of the states that have provided for the issuance of state licenses for aircraft and airmen, the following types of administrative agencies are provided for in their respective licensing statutes:[27]

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[26] See Department of Commerce Aeronautics Bulletin No. 18, p. 9. Effective February 5, 1929.

[27] Cf. *Supra,* classifications 3 and 4.

State	*Agency*
Arkansas	Honorary Aircraft Board
Florida	State Comptroller[28]
Connecticut	Commissioner of Aviation
Kansas	Aeronautic Board
Maine	Secretary of State[28]
Massachusetts	Registrar of Motor Vehicles[28]
Minnesota	Registrar of Motor Vehicles[28]
New Hampshire	Public Service Commission[28]
Pennsylvania	State Aeronautics Commission[29]
Oregon	State Board of Aeronautics

Five of the above states have utilized existing agencies, while the remaining five states have established independent agencies. New agencies have been created and established agencies utilized in some of the other states for performing specific tasks other than licensing of pilots and aircraft. Nebraska has assigned the duty of promulgating air traffic rules to the State Railroad Commission of that state.[30] New Mexico has authorized its State Corporation Commission to issue licenses to aircraft common carriers operating within the state.[31] Rhode Island has created a State Airport Commission to acquire land for a state airport.[32] Idaho has required the Commissioner of the Department of Public Works to survey, establish and maintain navigation facilities within the state.[33] Michigan has set up a State Board of Aeronautics "to adopt and place in force the Federal rules and regulations * * * having to do with the licensing

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[28] Existing agencies.
[29] The Secretary of Internal Affairs is chairman of this Commission.
[30] House bill No. 374, approved April 24, 1929.
[31] Committee substitute for Senate Bill No. 17, approved March 11, 1929.
[32] Chapter 1353, approved April 16, 1929.
[33] House bill No. 95 became chapter 137 of the Sessions Laws of 1929.

of aircraft and airmen and the regulations thereof."[34] Vermont requires every resident-owned aircraft and residence pilot to be registered with the Commissioner of Motor Vehicles. The sole requirements for such registration are the payment of a fee of five dollars and the proof that the aircraft and airmen to be registered have a current Federal license.[35]

Mr. Chester W. Cuthell admonition "that each of the states should proceed with great promptness to enact certain essential laws"[36] seems to have been acted upon with considerable alacrity by the state legislatures. This "great promptness" has resulted in a most amazing mass of varied types of state aeronautical legislation. In contrast to these varied methods of administration and licensing, the Special Joint Legislative Committee on Aviation of New York concluded that the creation of a bureau or department of aeronautics by the state legislature was unwise. "Inasmuch as there is no fee charged for a Federal license by the United States Department of Commerce it was decided that not only would the safety of the planes, pilots and passengers be amply safeguarded by requiring them to secure Federal licenses, but also that much expense would be saved to the taxpayers of the state in not having to create a new State bureau or department of aeronautics. Considerable expense would be saved to the pilots themselves in getting a free license from the United States Government rather than having to pay for one from some State department.

"The question of State regulation of aeronautics has

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[34] Act 148, approved May 15, 1929.

[35] Vermont Act 79, effective March 15, 1929. Although Vermont requires a state license, it has been listed as one of the states requiring a Federal license for all aircraft and airmen flying within their jurisdiction because of this provision of the Vermont Law.

[36] Address delivered at the annual meeting of the New York Bar Association, 1929.

also been given considerable thought. State borders in flying mean very little; it is easy to foresee a general complication if each State of the Union undertakes to pass various State laws, many of which would be bound to be in direct conflict with each other.

"It was agreed that in the interest of uniformity of regulation the creation of State Aviation Bureaus or Departments in this or any other State was distinctly bad, and it was hoped that conditions would never arise that would require it. This was not only the unanimous opinion of this committee but was also the unanimous opinion of all authorities with whom it was discussed.

"For that reason it is desired to make a matter of public record the exceedingly strong opposition felt by all against the establishment of such State Bureaus or Departments."[37]

The statement just quoted is in direct conflict with the conclusion of Mr. Chester W. Cuthell in respect to the most feasible method of licensing aircraft and airmen engaged in intrastate flying in New York.

In commenting on divergent opinions of this type, Professor H. J. Freeman makes this statement: "It is unfortunate that no authoritative studies have been made to indicate the most desirable solution to serve as a guide to intelligent legislation. Such a guide would be useful in directing the individual efforts of the various state legislatures in meeting these problems. Without such direction, the future of our legislation must be looked forward to with apprehension."[38] To promote further uniformity, he suggests that each state sponsoring aeronautical legislation should make an intensive study of similar legislation in other states. He also advises

[37] State of New York, Legislative Document (1929) No. 56.
[38] Aeronautical Chamber of Commerce, Legal and Legislative Bulletin No. 6, p. 6.

the accumulation of such data by some special agency such as the Aeronautical Chamber of Commerce. To assist the work of such a national agency he suggests the establishment of a permanent office in each state for the collection of all data relative to aeronautical activity within that state. "The lack of such authoritative sources of information as we have suggested makes impossible today the establishment of a prompt and efficient center of information, which everyone acquainted with these problems feels is imperatively needed."[39]

Because of the great activity of the states in the enactment of conflicting licensing legislation, it seems regrettable that the Federal Government did not seize the entire field of license regulation. The writer is not prepared to say that the registration and licensing by the Federal Government of all aircraft operating in the navigable airspace of the United States would be constitutional, but in consideration of the Federal regulations in the field of maritime law, such constitutionality does not seem entirely improbable.[40] Congress has seen fit to apply registration and safety inspection to vessels engaged in operation upon the navigable waters of the United States, whether or not the particular commerce was interstate or intrastate commerce. The first regis-

[39] Aeronautical Chamber of Commerce, Legal and Legislative Bulletin No. 6, p. 6.

[40] In the Report of the Committee on the Law of Aeronautics to the American Bar Association (47 Am. Bar Assn. 413) the following excerpt might be noted: "In the opinion of the Committee, the Supreme Court has gone so far in allowing the regulation of interstate commerce by a Federal agency that there is no doubt that this court would support a Federal status giving the Federal Government exclusive power to register aircraft, license pilots and establish rules for aerial navigation. If an intrastate aircraft is not registered and inspected, its flight may endanger the safety of aircraft engaged in interstate commerce. If a pilot engaged in intrastate flight alone is unskilled and unlicensed, his conduct may well endanger the safety of pilots engaged exclusively in interstate flight; and if the rules for intrastate aerial navigation are different from those applying to interstate flight, confusion and danger to interstate flight may well ensue."

tration law of 1789 (1 Stat. 55, 58) applied to all vessels upon the navigable waters, and the first Safety Inspection Act of 1838 (5 Stat. 304) was similarly applied. Such application of the marine navigation laws has been held constitutional.[41] Operating on a similar theory, that the Federal Government cannot effectively protect, encourage and control interstate and foreign commerce by air if Federal inspection of aircraft and airmen does not extend to all aircraft operating in the navigable airspace of the United States, there appears to be some possibility that the court might decide such legislation constitutional.

In the absence of such Federal mandatory licensing legislation for all aircraft, the problem of securing uniformity in state licensing legislation must be faced. The probability that local state conditions might make feasible the adoption of varying requirements for airworthiness of aircraft and competency of pilots seems rather remote. The existence of such a probability seems to be the only reasonable excuse for individual state requirements in licensing regulations. The most practical and efficient solution of the question of securing uniformity and safety in state requirements would seem to be the adoption by the various states of the Department of Commerce Draft requiring Federal licenses for all aircraft and airmen flying within their jurisdiction.

The Uniform State Law for Aeronautics

The so-called Uniform State Law for Aeronautics was prepared by the Conference of Commissioners on Uniform State Laws and adopted by the conference and recommended by the American Bar Association at the

[41] City of Salem, 37 Fed. 846; Oyster Police Steamers, 31 Fed. 763, and 33 Op. Att. General 500.

annual convention of the American Bar Association in August, 1922. The recommended draft represents one of the first attempts to secure uniformity in state aeronautical legislation. It was designed to be a declaration of rights by the states setting forth the guiding rules relating to airispace ownership, airspace sovereignty, legality of flight, actions for damages, and prohibited flight. The drafting committee assumed that the establishment of rules for air navigation and the licensing of aircraft and airmen should be left for Federal regulation because of the almost universal interstate nature of flight. In respect to this draft the Commerce Department states on September 1, 1929, that: "It is deemed by some authorities to be inconsistent with recent and impending developments in air transportation, and that suitable regulatory legislation will more nearly accomplish the desired purpose."[42]

The Uniform State Law for Aeronautics contains the following principal provisions:

1. Sovereignty of airspace above the lands and waters of the State is declared to rest in the State. Section 2.
2. Ownership of airspace is declared to be vested in the owners of the surface beneath. Section 3.
3. Flight at a reasonable height is declared lawful. Section 4.
4. Operators of aircraft are declared to be absolutely liable for all damages to persons and property on the land or water beneath. Section 5.
5. Dangerous flying is prohibited. Section 9.
6. Hunting from aircraft is declared a misdemeanor. Section 10.

The chief opposition of the law has been encountered in the absolute liability provision of Section 5.

[42] Aeronautics Bulletin No. 18, p. 71.

During the year 1929, the Uniform State Law was adopted in nine states.[43] The absolute liability section was omitted in three of these state statutes. Professor Harry J. Freeman comments that these exclusions together with the fact that so few of the states which have considered the bill have adopted it "would seem to indicate a decided tendency to repudiate the theory of absolute liability as expressed therein."[44]

The following states have adopted in whole or in part the Uniform State Law for Aeronautics:

State	*Statute*
Arizona (1929)	Chapter 38
Delaware (1923)	Chapter 199
Hawaii (1925)	Rev. L., Sec. 3894-3905
Idaho (1925)	Chapter 92
Indiana (1927)	Chapter 43
Maryland (1927)	Chapter 637
Michigan (1923)	Chapter 224
Minnesota (1929)	Chapter 219
Missouri (1929) omitting section 5	L. 1929, p. 122
Montana (1929) omitting section 5	Chapter 17
Nevada (1923)	Chapter 66
New Jersey (1929)	Chapter 311
North Carolina (1929)	Chapter 190
North Dakota (1923)	Chapter 1
Pennsylvania (1929) omitting section 5	Act 317
South Carolina (1929)	Act 189

[43] In addition to these nine states, Rhode Island included the essential provisions of the Uniform State Law, including the absolute liability section, in a licensing and regulative statute, Chapter 1435, approved April 27, 1929.

[44] *Air Law Review,* Vol. I, p. 70.

South Dakota (1925)	Chapter 6
Tennessee (1923)	Chapter 30
Utah (1923)	Chapter 24
Vermont (1923)	Chapter 155
Wisconsin (1929)	Chapter 348

State Legislation on the Establishment and Operation of Airports

Uniformity in state legislation concerning the establishment and operation of airports is not of particular importance. The general character of such legislation will depend upon the fiscal legislation of the state. The Department of Commerce has submitted a draft for such legislation but states that the draft is simply "a suggested premise for States desiring to acquire landing fields and airports."[45] In brief, this draft authorizes the legislative body of any city, village, town, or county to acquire, establish, construct, own, lease, equip, improve, maintain, operate and regulate airports and landing fields.[46] Lands so used are declared to be occupied as a matter of public necessity and for a public purpose.[47] Political subdivisions are empowered to use condemnation as a means of acquiring the necessary lands, appropriate money or issue bonds for the establishment and maintenance of airports, and, if necessary, vest jurisdiction for the construction, maintenance, equipment and operation thereof in any suitable officer, board, or body of such city, village, town, or county.[48]

Most of the state legislation pertaining to airports may be classified into two groupings:

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[45] Aeronautics Bulletin No. 18, p. 4; for full text of draft, *ibid.*, pp. 7, 8.
[46] *Ibid.*, sections 1, 2.
[47] *Ibid.*, section 3.
[48] *Ibid.*, sections 4, 5.

1. General statutes authorizing political subdivisions of the state to acquire, establish, and operate airports and landing fields. This type of legislation has been enacted in thirty-six of the states.[49] The specific enactments of these states are widely divergent in content. Some of the statutes are easily identified as copies of the Department of Commerce Draft.[50] The Pennsylvania legislature has passed specific airport enabling acts for counties of the second class, and cities of the first, second and third classes.[51] Two other airport acts of this state provide that the county commissioners may appropriate money to assist any city within their county to acquire aviation landing fields, and that all airports in the state must obtain a license from the State Aeronautics Commission.[52]

2. Special statutes pertaining to the establishment of a specific airport by a political subdivision of the state or by the state itself. While there are several recent examples of such legislation, the general trend seems to be toward the broader type of legislation empowering political subdivisions as a class to acquire, establish, and operate airports. It seems unwise to authorize the establishment of every municipal, town, or county airport by a specific act of the state legislature. Although South Carolina has no general airport enabling act, its legislators enacted four separate bills permitting cities or counties in the state to acquire land for airport pur-

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[49] The states not having municipal airport enabling acts are Alabama, Colorado, Delaware, Georgia, Maine, Mississippi, Nevada, Rhode Island, South Carolina, Tennessee, Utah and Virginia.

[50] Typical examples would be the Arizona law, Chapter 38, approved March 6, 1929, and the West Virginia law, Senate bill No. 48, passed February 13, 1929.

[51] Act of May 21, 1923, P. L. 295; Act of May 21, 1923, P. L. 296; Act of May 12, 1925, P. L. 614; Act of May 13, 1927, P. L. 1020, amended by the Act of May 7, 1929, P. L. 1582.

[52] Act of May 2, 1929, P. L. 1278; Act of April 25, 1929, P. L. 724, Section 201-e.

poses.[53] Typical of special legislation authorizing state agencies to procure, establish and operate airports are the laws of Kentucky,[54] and Rhode Island.[55] The Kentucky law provides that the Air Board "shall provide airports and air routes * * * for the State of Kentucky."[56] The Rhode Island law permits the State Airport Commission to obligate the state not in excess of $250,000 for the purchase of land for a state airport.

Legality of State Airport Legislation

The entire question of the constitutionality of legislation permitting a political subdivision of the state to acquire land for airport use involves the principles of constitutional law prohibiting the expenditure of public money, or the levying of taxes, or the issuance of bonds, for a private purpose. Those courts which have considered the question have, without exception, decided that the establishment of an airport by a political subdivision of the state is a public purpose.

In Missouri, the Supreme Court of that state has held in two cases[57] that municipalities possessed the implied power from their charters to acquire airports without the sanction of a state airport enabling statute. The arguments advanced in support of the contention that the establishment of an airport was not a public purpose were couched in the following phraseology:

> It (the airport) will afford a starting and landing

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[53] Laws of South Carolina, No. 440, approved March 14, 1929; No. 461, approved March 1, 1929; No. 538, approved March 16, 1929; No. 562, approved March 14, 1929.

[54] An act passed by the 1926 General Assembly became a law July 1, 1926.

[55] Chapter 1353, approved April 16, 1929.

[56] 1926 General Assembly, passed July 1, 1926, section 2.

[57] Dysart v. City of St. Louis, 11 S. W. (2d) 1045; Ennis v. Kansas City, 11 S. W. (2d) 1054. Both cases decided December 6, 1928.

place for a few wealthy, ultra-reckless persons, who own planes and who are engaged in private pleasure flying. They may pay somewhat for the privilege. It will afford a starting and landing place for pleasure tourists from other cities, alighting in St. Louis while flitting here and yon. It will offer a passenger station for the very few persons who are able to afford and who desire to experience the thrill of a novel and expensive mode of transportation.

The number of persons using the airport will be about equal to the total number of persons who engage in big-game hunting expeditions to the African wilderness, and voyages of North Pole exploration.

In the very nature of things, the vast majority of the inhabitants of the city, a 99 per cent majority, cannot now and never can, reap any benefit from the existence of an airport.

True it may be permitted to the ordinary common garden variety of citizens to enter the airport free of charge, so that he may press his face against some restricting barrier, and sunburn his throat gazing at his more fortunate compatriots as they sportingly navigate the empyrean blue.

But beyond that, beyond the right to hungrily look on, the ordinary citizen gets no benefit from the taxes he is forced to pay.

The court rejected these contentions, admitted that the airplane is not in general use as a means of travel or transportation, but observed that within a few years the airplane will be used as generally as any of the other recognized agencies of transportation. An airport, said the court, "is a necessary instrumentality in a new method or system of transportation which requires public aid for its development and final establishment."

In another case[58] the Supreme Court of Oregon,

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[58] McClintock v. City of Roseburg, 127 Oregon, 698, 273 Pac. 331, decided January 8, 1929.

in denying the plaintiff the right to enjoin the City of Roseburg from issuing bonds under statutory authority for purposes of airport establishment, uses the following language:

> What is a public use is not capable of an absolute definition. A public use changes with changing conditions of society, new appliances in the sciences and other changes brought about by increased population and modes of transportation and communication. We cannot close our eyes to the great growth in the use of flying machines during the past decade. This growth has been especially noticeable during the last two or three years. We must take notice that a large quantity of mail is being daily transported into the various parts of the country. Expressage and even freight is being transported by aeroplane in large and rapidly increasing quantities. Transportation by air appears to be increasing so rapidly that we may confidently expect that soon a large portion of the mail and express will be transported by aeroplane. An airport owned by the city open to the use of all aeroplanes is for the benefit of the city as a community, and not of any particular individuals therein. It is therefore a public enterprise. Aeroplanes travel the "trackless air." The only way an aeroplane company could acquire a monopoly would be through monopolizing the airport. It would seem, therefore, that airports may be properly owned and controlled by a municipality or other public corporation. Such has been the holding of all the courts passing upon the question directly.

In referring to this case, Professor Harry J. Freeman makes this comment: "Probably the most apt statement of the rationale of the decisions of the courts on the question (use of an airport as a public purpose) was made by the Supreme Court of Oregon."[59] Because of

[59] *Air Law Review,* Vol. I, p. 143.

the unanimity of the decisions of the courts of the various states, there is, probably, sufficient precedent to conclude that the constitutionality of state airport enabling acts is fairly well established. At least, it can be said, that to date every case handed down by the state courts have decided that airport operations by a political subdivision of the state is a public purpose.[60]

Miscellaneous State Legislation

In addition to licensing and airport legislation many of the states have enacted bills of a widely divergent character but pertaining to some phase of aviation. It is not the purpose of this description to present every type of such legislation but to indicate some of the more prevalent types in order to round out the picture of state legislation.

At least five of the states have defined all aircraft carrying persons or property for hire as common carriers.[61] Most of these states require such common carriers to be licensed by some authorized state agency.[62] Proceeding one step further, it is interesting to note

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[60] For cases affecting this question note: State ex rel. Hile v. City of Cleveland, 26 Ohio App. 158; City of Wichita v. Clapp, 125 Kan. 100; Doughty v. Mayor and City Council of Baltimore, 155 Md. 125; State ex rel. City of Lincoln v. Johnson, 220 N. W. 273 (Neb.); Hesse v. Rath, 249 N. Y. 436; State ex rel. Chandler v. Jackson et al., 167 N. E. 396 (Ohio 1929). Cases already cited are not repeated in this listing.

[61] New Mexico, L. 1929, ch. 71; Pennsylvania, 1929, Act 317; Arizona Corporation Commission Order, No. 113-L; Louisiana, L. 1926, Act No. 52; Nevada, Regulations of Public Service Commission, February 5, 1929.

[62] In Pennsylvania this agency is the Public Service Commission; a certificate of safety must also be obtained from the State Aeronautics Commission. In New Mexico, the State Corporations Commission; in Arizona, the State Corporations Commission; in Nevada, the Public Service Commission. The Pennsylvania Public Service Commission has already applied the competitive principle in refusing a charter to a company whose creation would bring about destructive competition; Application of Battlefield Airways, Inc., 17 Pa. C. R. 410, 1929 U. S. Av. R. 54.

that the Railroad Commission of California believes it possesses the authority under the provisions of the State Constitution to regulate rates and require the filing of tariffs by aircraft common carriers.[63]

During the legislative sessions of 1928-29, five of the states enacted laws permitting railroads to purchase and operate equipment for air transport services.[64] This particular type of legislation was to be expected following the formation of several air-rail services during 1929.

The possible dangers of aircraft use have been recognized by the states in various ways. California has authorized the Director of Agriculture of that state to inspect aircraft for plant pests.[65] Fourteen states have forbidden the use of aircraft in hunting.[66] Nebraska prohibits the transportation of narcotics by airplane.[67] Indiana and South Dakota forbid the use of aircraft for the carrying of intoxicating liquors.[68] North Carolina and Indiana make the theft of an airplane a criminal offense.[69]

Some of the states recognizing the value of aeronautical education have made appropriations for this purpose. Tennessee[70] proposed to establish a school for

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[63] Constitution of California, Section 22, Article XII: "The Railroad Commission shall have the power to establish rates of charges for the transportation of passengers and freight by railroads and other means of transportation companies." A very scholarly paper has been written on this subject by Warren Jefferson Davis, *Air Law Review,* Vol. I, p. 47.

[64] Iowa, L. 1929, ch. 133; Illinois, L. 1929, p. 590; Michigan Public Acts of 1929, No. 193; Missouri, L. 1929, p. 345; Wisconsin, L. 1929, ch. 201.

[65] California, L. 1929, ch. 247.

[66] 1929 U. S. Av. R. 929.

[67] Nebraska, L. 1929, ch. 162.

[68] South Dakota, L. 1929, ch. 168; Indiana, L. 1929, ch. 134.

[69] Indiana, L. 1917, p. 174; North Carolina, L. 1929, ch. 90.

[70] Tennessee, Public Acts 1929, ch. 114.

pilots and New Jersey[71] and Washington[72] have given funds for aeronautical study to educational institutions.

Laws exempting the aviation business from taxation have been passed in several states. Florida has exempted aircraft manufacturers from taxation for a period of fifteen years.[73] Georgia[74] and Connecticut[75] have enacted legislation which exempts from taxation all property owned by any city or town and used for airport purposes even if the airport is located in another town. Vermont[76] permits a town to exempt from taxation publicly or privately owned airports for a period of five years. An opposite tendency has been exhibited by Idaho, Indiana and Michigan, who levy a tax on gasoline used for aircraft purposes.[77]

Other legislation has dealt with subjects of varying character. The insurance of air risks is authorized in California, Massachusetts, Michigan, New Jersey, Ohio, and Iowa.[78] Virginia requires liability and property damage insurance as a requisite for commercial operations.[79] Michigan has provided for the mapping of the state by aerial photography.[80] Ohio has passed a law which is heartily approved by the Department of Commerce. It requires, in brief, that "the legislative authority of each and every municipality in the State of Ohio shall cause said municipality to be marked for aeronau-

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[71] New Jersey, L. 1920, ch. 21.
[72] Washington, L. 1929, ch. 56.
[73] Florida, L. 1929, S. J. R. 89.
[74] Georgia, L. 1927, p. 779.
[75] Connecticut, Public Acts 1929, ch. 135.
[76] Vermont, L. 1929, No. 20.
[77] Idaho, L. 1929, ch. 283; Indiana, L. 1923, ch. 182; Michigan, Public Acts 1929, No. 157.
[78] California, L. 1929, ch. 193, Sec. 394; Massachusetts, L. 1928, ch. 106; Michigan, L. 1929, No. 154; New Jersey, L. 1929, S. B. 204; Ohio, L. 1925, p. 54, Sec. 1; Iowa, L. 1929, ch. 229.
[79] Virginia, L. 1928, ch. 463.
[80] Michigan, L. 1929, Act 247.

tical purposes."[81] The creation of temporary commissions to study aeronautical development to serve as a guide for future legislation was an additional outgrowth of the legislation of 1929. California, Illinois, New Jersey, New York, Oregon and Wisconsin have created such bodies.[82] The importance of this type of activity in the promulgation of efficient legislation cannot be overemphasized.

Summary

From a comprehensive study of aeronautical legislation, several observations might be noted:

1. The Air Commerce Act of 1926 has definitely limited the jurisdiction of the Federal enforcement agency, the Department of Commerce.
2. Such limitation of Federal jurisdiction has permitted the states to enter the regulation field.
3. The uniformity of regulative requirements is highly desirable for such a mobile agency of transportation as the airplane.
4. The Air Commerce Act of 1926 is deficient in jurisdictional scope to accomplish such uniformity.
5. Many of the states, exercising their regulative rights in the field of interstate commerce, have not generally succeeding in insuring such uniformity.

Assuming the above to be true, two courses of action may be pursued in securing uniformity in licensing regulations:

1. An attempt to secure uniformity in licensing

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[81] Ohio, L. 1929, p. 28, Sec. 6310-44.

[82] California, Assembly Concurrent Resolution, No. 9, 1929, ch. 67; Illinois, L. 1929, H. J. R. 49; New Jersey, Joint Resolution, No. 2; New York, L. 1929, ch. 53; Oregon, L. 1929, ch. 352; Wisconsin, L. 1929, H. J. R. 60.

regulation by urging the adoption of a uniform law by the forty-eight state legislatures.

2. The enactment of Federal legislation enlarging the regulative jurisdiction of the Federal enforcement agency.

In considering the first solution, it has certainly been true that attempts to secure uniformity of state legislation in other fields has not proven to be generally satisfactory. From the most cursory examination of the various types of state legislation on the licensing of aircraft and airmen, it is obvious that uniformity has not been attained in such regulation among the forty-eight states. Even if it were possible to secure the word for word adoption of a uniform statute by every one of the forty-eight states, such legislation would not remain uniform because it would be interpreted by the courts of forty-eight judicial systems.

The author believes that the most logical solution is the enlargement of Federal jurisdiction. It may be argued that since the Federal Government is one of limited powers, there is no authority to regulate intrastate matters. The regulation of aviation is but one of a series of regulative problems in a Federal form of government. When it was deemed necessary to extend the Federal jurisdiction over railroads the courts decided that the Federal Government was not without authority to regulate intrastate operation when such operation constituted a burden on interstate commerce.[83] Walter F. Dodd has said: "It is impossible to draw any definite or permanent line between national and state functions. Railroad regulation began with the states and has properly tended to come under national control. The line

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[83] Southern Ry. v. U. S., 222 U. S. 20; Shreveport Case, 234 U. S. 342; Wis. v. C. B. & Q. Ry., 42 Supp. Ct. 232.

separating state and national functions must and will shift. With the development of interstate commerce by railroad, it has become increasingly necessary that the United States Government assume increasing authority over regulation of intrastate carriers."[84]

The Federal Government has exercised similar jurisdiction over intrastate radio communication. It has applied the registration and safety inspection laws to vessels engaged in intrastate operation on the navigable waters of the United States. Such a mobile agency of transportation as the airplane should not be hampered by conflicting state legislation. A distinctly national solution must be sought. This solution, the author believes, is the extension of Federal licensing jurisdiction so as to include all aircraft and airmen.

In respect to state legislation permitting political subdivision to establish airports, the necessity of uniformity is not of great importance. It is primarily a local problem and as such should be dealt with by the various state legislatures. If such legislation facilitates airport establishment, it co-ordinates admirably with the airport development work of the Department of Commerce. The general type of airport enabling act empowering political subdivisions as a class to acquire, establish and operate airports seems preferable to other types.

The present tendencies of aeronautical legislation of a miscellaneous character, as previously noted in this chapter, might be observed with considerable apprehension by the aviation industry. State requirements for common carriers and the probability of rate regulation by a state agency are possible dangers to aeronautic development. When the time is ripe for such regulation, it would seem that the uniformity assured by Federal regulation would be more desirable.

[84] *Yale Law Journal,* 892 (1918).

X

LEGAL PROBLEMS

The invention of a means of aerial navigation has opened an entirely new field of speculative thought and legal development. Any discussion of the administration of aviation by a Federal or a State agency necessarily involves that most fundamental problem, the right of flight. Unless this right exists there can be neither regulation nor even aviation. If the owner of land possesses complete proprietary rights in the airspace above his land, then such rights form insurmountable barriers to the use of such airspace as a medium of transportation. The legal problem, which the writer proposes to consider in this chapter, revolves itself into a conflict between the inevitable growth of aviation with its accompanying court decisions and legislative pronouncements of enlightened judges and legislatures, and the firmly established principle of common law, *Cujus est solum, ejus est usque ad coelum et ad infernos.* Coke translates this maxim: "To whomever the soil belongs, he owns the sky and also to the depths."[1]

Mr. H. G. Hotchkiss comments that "there can be little doubt but that the owner of land today has some rights in the airspace above him and there can be equally little doubt that the extent and nature of his right is still far from settled."[2] Since the Air Commerce Act of 1926 has assumed that the legal right of flight through

[1] Coke Litt., p. 4a; 17 C. J. 391.

[2] H. G. Hotchkiss, *Aviation Law* (1928), p. 12. For other opinions see Pollock, *Law of Torts* (1920 Ed.), p. 352; Burdick, *Law of Torts* (1926 Ed.), p. 406; Salmond, *Law of Torts* (1912 Ed.), p. 171.

the navigable airspace does exist, it would seem not amiss to discuss the effect of this assumption on the common law maxim stated above.[3]

Equally as fundamental would be a discussion of the liability of an aircraft operator for injury to persons or property on the ground. Should such operators be held to an absolute liability? Should the rule of negligence of the ordinary tort case be applied requiring the plaintiff to prove the tort and establish the act of omission which constitutes negligence? Or would it be advisable to adopt the suggestion that the "res ipsa loquitur" doctrine should apply in cases arising out of injuries caused by operators of aircraft to persons or property on the ground? In respect to these possibilities, it seems advisable to examine legislation pertaining to the question of liability, the few court decisions on that subject, and the opinions of the leading legal authorities.

Airspace Ownership

If the often quoted maximum,*"Cujus est solum, ejus est usque ad coelum et ad infernos,"* is to be taken literally, then any passage of an aeroplane at whatever height constitutes a technical trespass. It is an established principle of common law that in general no one has the right to trespass on the property of another, and such trespass would constitute a violation of legal rights and could be enjoined. It is also established that the right of the state to take private property for a public use can only be exercised when a just compensation is paid. This latter rule might be modified by utilization of the Police Power of the state. Modification, however, is not possible, if technically, the common law rule

[3] For a legal history of the maxim, consult Coke, *Litt.*, Lib. 1, Section 1, p. 4; 2 Blackstone, *Commentaries* 18.

that navigation of the air must depend upon who owns the airspace above the earth is recognized. The state would then be bound to protect the owner in his uninterrupted use and occupancy. Major Elzo C. Johnson, J.A.G.D., has written an article supporting this view:[4]

> It is therefore a safe conclusion that technically under the present grants and prohibitions of the Constitution and the common law rule of ownership of space above property neither the United States Government nor the states have any jurisdiction over the air. Until public highways are established in the air no commercial rights of either interstate or intrastate can be legally given for air travel.

In opposition to this view Simeon E. Baldwin,[5] an authority on the law of aeronautics, states:

> This maxim (*Cujus est solum, ejus est usque ad coelum et ad infernos*) was not derived from the nation whose language is used for its statement . . . and is foreign to the conceptions of the Roman law as to what is the property of all. It is the production of some black-letter lawyer, and, like every short definition of a complex right must be taken with limitations.
>
> It would seem that one of these must be that a proprietor of land could not be heard to complain of any use of the air above it by which no injury to him can result. In other words, the law will hardly aid him by giving a remedy in court where there has been and could have been no actual damage. His right, if any, is too tenuous for the state to defend by its active interference.
>
> Perhaps we may go further and say that he has no legal right at all over the airspace above his land, except insofar as its occupancy by others could be of injury to his estate.

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[4] Air Service Information Circular V. 6, No. 566, p. 29.

[5] Governor and Ex-Chief Justice of Conn. and authority on Aviation Law, see 4 Am. J. of Int. L. 95.

If we are to resort to ancient legal maxims to prove ownership of airspace, we might resort to that legal phrase, *damnum abseque injuria.* Granted the ownership of the airspace to the subjacent owner of the soil, the law would grant him no relief if the trespass by air resulted in a "damage without injury." Another legal maxim is *de minibus non lex curat,* that is, concerning insignificant things, the law gives no cure. If the trespass by air resulted in no diminution of the property owner's enjoyment of his land, there would be no legal remedy.

English Cases

The first mention of the legal problems that might arise as a result of the use of the air as a medium of transportation was in the English case of Pickering v. Rudd.[6] This case involved a projecting barber sign. Lord Ellenborough was of the opinion that it was not a trespass. The case was decided in 1815 at the same time that the British were waging the battle of Waterloo and in the early days of the balloon. Lord Ellenborough commented that he was "by no means prepared to say that firing across a field *in vacuo,* no part of the contents touching it, was a *clausum fregit.*" He continued with this remarkable sentence, "Nay, if this board overhanging the plaintiff's garden be a trespass, it would follow that an aeronaut is liable to an action for trespass *quaere clausum fregit* at the suit of every occupier of every field over which his balloon passes in the course of his flight." In 1865, Lord Blackburn admitted the "good sense of that doubt, but not the legal reason of it."[7]

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[6] Pickering v. Rudd, 4 Camp. 219.
[7] Kenyon v. Hart, 32 L. J. Rep. 87.

An opposing decision of the English Court is found in Clifton v. Bury. The plaintiff brought action to stop the shooting over his land from the Wimbledon Rifle Ranges which adjoined his land. The court found for the plaintiff. While this decision appears contrary to the reasoning of Lord Ellenborough in the Pickering v. Rudd case, it would be well to note that Sir Henry Hawkins in writing the opinion stressed the point of actual interference with the enjoyment of the land by the plaintiff:

> Certainly it will cause no unreasonable alarm which renders the occupation of that part of the farm less enjoyable than the plaintiff is entitled to have it.

French Cases

Two cases, which test the "ad coelum" maxim,[8] have been tried in the French courts. In both cases the facts are substantially the same. The plaintiffs were owners of small farms located close to the Farman airport. The complainants sued for damages due to forced landings on their properties, the frightening of horses, the damaging of crops and other damages resulting from the attraction of crowds. They also sued to enjoin the Farman Company from flying over their land. The court granted damages in both cases but refused the injunction. In the case of Huerterbrise v. Esnault, Farman, Pelterrie et al, the court said, "If in the terms of the texts cited, ownership of the soil carries with it effective ownership above the soil, this principle must restrict itself reasonably to the advantages of the proprietor according to the heights of the air usable to him, either in the way of buildings or accessories of buildings, such as architects

[8] Brinquant, Mauge, et al, v. Farman, *Révue Juridique*, 1912, p. 282; Huerterbrise v. Esnault, Farman, Pelterrie, et al; 48 *Am. Law Rev.* 914, 1914.

and engineers can conceive and realize, or from the standpoint of cultivated land generally. As to that which is above this height, estimated and fixed according to knowledge and experience, and deduced from common sense, scientific rules and the special circumstances of each case, the freedom of the air is complete. Circulation Arienne is in the present state of the law free from all restraint, and should not call forth new claims on the part of the proprietors of land over which flight takes place." This reasoning of the court leaves little room for doubt as to the French interpretation of the *ad coelum* maxim.

Among the more recent writers and authorities, the opinion is generally maintained that the *ad coelum* theory is an antiquated one. Professor de Montmarency[9] says that "the maxim is not recognized." Another authority declares "that there are no cases extending the right of an owner beyond the space above his land necessary to its reasonable use."[10] Carl Zollman, in his book "Law of the Air," states that, "the maxim is a glittering phrase which has not arisen out of any contested law suit." Baldwin asserts that the old maxim was absurd for the owner of the land "could not complain of any use of the land which did not injure him,"[11] while Henry C. Spurr makes the emphatic statement that "conditions will warrant the courts in overthrowing the common law maxim."[12]

Henry C. Spurr admits the possibility of contested free flight in airspace over private property when he suggests that the courts would be warranted in "overthrowing the common law maxim." Arthur K. Kuhn expresses a similar doubt when he writes, "The maxim of

[9] *British Year Book of International Law*, 1921-22, p. 167.
[10] O. M. Biggar, *Canadian Law J.*, Vol. 48, No. 2, p. 63.
[11] 4 *Am. J. Int. Law*, p. 95.
[12] 18 Case and Comment 119.

the law already referred to should not be extended to conditions which did not exist and were not conceived of at the time of its origin. Its phraseology has been referred to by an English judge as at best a 'fanciful phrase.' The view here favored, by which the landowner's rights in the airspace are regarded as strictly appurtenant to the soil and to be accorded only when essential to the enjoyment of the latter, will tend to reconcile the interests of the landowner with the progress of the new art. The latter is deserving of every reasonable encouragement through law."[13]

The point of view of Kuhn seems logical. He admits the right of the landowner to prevent any denial of his enjoyment of the use of his land which may be occasioned by the passage of aircraft over his property. He also indicates that passage which does not interfere with such full enjoyment should be allowed by the courts.

United States Cases

Upon examination of several cases decided in the courts of the United States, it is shown conclusively that the American courts have not given their unqualified acceptance to the *ad coelum et ad infernos* maxim. The maxim does not grant title to water of a stream passing over the land of a riparian owner despite the fact that he owns the fee to the center of the stream.[14] Neither does an owner receive absolute title to gas or oil beneath his property until he has captured it.[15] In view of the principle that the right to possession or to control possession is a necessary element in the ownership of land, it would appear that it would be more possible

[13] Arthur K. Kuhn, The Beginnings of Aerial Law, 4 Am. J. Int. Law, 123.

[14] Gratz v. McKee, 270 Fed. 713, 1920 (C. C. A. 8th Circuit.)

[15] Walls v. Midland Carbon Co. 254 U. S. 300, 41 Sup. Ct. 18, 1920.

for an owner to possess oil, water, or gas, in or under his property than air three thousand feet above it.

Several cases have been decided in the state courts of the United States dealing directly with the question of trespass by aircraft. These cases do not deal with the precise point of ownership of airspace, but indicate the probable attitude that the judges will assume when the question is squarely placed before them.

The first of these cases is a decision of the Jefferson County Court of Quarter Sessions of Pennsylvania.[16]

Oscar P. Grube, the prosecutor, was the owner of a farm adjacent to a landing field used by Harold O. Nevin engaged in the business of carrying passengers for short flights in an aeroplane. It appears that on July 13, 1922, Nevin, operating the aeroplane with a passenger on board, flew over the Grube farm. The aeroplane, when it first came over the Grube farm was flying at an altitude of fifty feet, and the height was increased to three hundred and fifty feet by the time its passage over it was terminated. Grube had posted his iand against trespass in accordance with the provisions of the Pennsylvania act of April 14, 1905, P.L. 169. The opinion of the court was given by Judge Corbet: "At the time of the passage of this act in question, it seems improbable the legislature had in contemplation the flight of an aeroplane over land, or that it intended to classify such flight, if made, as in every instance a wilful and unlawful trespass upon land punishable under the act. * * * Before incurring the penalty of the act, it is essential that the alleged trespasser shall have been first warned by notices 'posted upon the land' where they might be seen. But it seems incredible the legislature

[16] Commonwealth v. Nevin and Smith, 2nd Dist. and Co. Rep. (Pa.) 241.

would expect 'printed notices' posted upon the land to be seen by an aviator in rapid flight over a piece of land, or that he could or would descend, alight, ascertain property lines, and then look for notices in order to determine —if not already a trespasser and arrested as such— whether he was at liberty to proceed or go no further— than, to jail, perhaps. Clearly it cannot be said that the flight of an aeroplane over land was, at the time of the passage of the act, such a thing as was, and always had been, a trespass upon land. 'Wilfully to enter upon land,' as used in the act, indicates an encroachment or an interference with the owner's occupation of his soil; but is not synonymous with a flight through the air over it, which has yet, so far as we are aware, to be held an entry upon it, and a meaning of the term not heretofore attributed to it. The Court is of the opinion that the Act of April 14, 1905, P.L. 169, is not applicable and does not warrant the present prosecution."

This case must not be interpreted as a decision on airspace ownership. That point was entirely evaded in the reasoning of the court. The case is important as indicative of a very liberal point of view toward the use of airspace for aerial navigation.

The second case was tried in the County of Ramsey, District Court, Second Judicial District of Minnesota, on September 27, 1923.[17] In June, 1923, one of the defendants's airplanes, by reason of some mechanical defect, fell upon the plaintiff's lawn. Action was brought to recover damages for resultant injuries, and to enjoin the defendants from operating any aircraft over the plaintiff's premises, regardless of the altitude of such flights. The only legislation on the subject then in effect

[17] Robert Johnson v. Curtiss Northwest Airplane Company et al not otherwise reported except as stated in text.

in Minnesota was a statute which forbade all trick flying, or aerial acrobatics, or any flight at a less altitude than two thousand feet, over any city of the first class.[18] The act implies the rightful existence of air navigation by this limited regulation, but the act does not attempt to define liability of navigators or rights of owners of land over which air flights are made. The plaintiff invokes the *ad coelum ad infernos* maxim and maintains that any flight over his land at whatever altitude constitutes actionable trespass.

Judge Michael, in his opinion, states, "The upper air is a natural heritage common to all the people, and its reasonable use ought not to be hampered by an ancient artificial maxim of law such as is here invoked. To apply the rule as contended for would render lawful air navigation impossible, because if the plaintiff may prevent flights over his land, then every other land owner can do the same. Common law rules are sufficiently flexible to adapt themselves to new conditions arising out of modern progress, and it is within the legitimate province of the courts to so construe and apply them. . . . The air, so far as it has any direct relation to the comfort and enjoyment of the land, is appurtenant to the land, and no less the subject of protection than the land itself, but when, as here, the air is to be considered at an altitude of two thousand feet or more, to contend that it is a part of the realty, as affecting the right of air navigation, is only a legal fiction, devoid of substantial merit. Under the most technical applications of the rule, air flights at such an altitude can amount to no more than instantaneous, constructive trespass. Modern progress and great public interests should not be blocked by unnecessary legal refinements."

[18] Chapter 433, Laws of Minnesota, 1921.

The court further pointed out that failure to sustain the plaintiff's contention relative to upper air trespass did not militate against his rights and remedies for recovery of damages in cases of actual trespass or the commission of a nuisance.

The case is unsatisfactory as a decision on airspace ownership for two reasons: first, a state statute was already in existence, exercising the police power of the state, prohibiting flights at less than two thousand feet; second, the decision was rendered by a lower court and not a court of last resort.

A decision has just been handed down by the Supreme Judicial Court of Massachusetts in which the question of airspace ownership was reviewed.[19] The plaintiff alleged that he is the owner of a country estate, that he had bought this estate with the express purpose of securing a place of quiet, peace and absence of noise. In 1927, the defendant purchased land adjoining this estate and is using it for an airport. The plaintiff contended that the defendant continued to fly over his estate in such an unreasonable and noisy manner as to constitute a trespass and a nuisance. The plaintiff sought to permamently enjoin the defendent from using airplanes in such a manner as to constitute a trespass and a nuisance. The injunction was denied by the court.

Although assuming that private ownership of airspace extends to all reasonable heights above the underlying land, the court said, "it would be vain to treat property in airspace upon the same footing as property which can be seized, touched, occupied, handled, culti-

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[19] Reported in *United States Daily,* March 12, 1930, p. 1. Harry Worcester Smith et al v. New England Aircraft Co., Inc., Worcester Airport, Inc. Decision of the lower court reported in 1929, U. S. Av. R. 27. Compare Swetland v. Curtis Airports Corp., 1930, U. S. Av. R. 21; 41 F. (2nd), 929.

vated, built upon and utilized in its every feature. The experience of mankind, although not necessarily a limitation upon rights, is the basis upon which airspace must be regarded. Legislation with respect to it may rest upon that experience. It is the proper function of the legislature in the exercise of the police power to consider the problems and risks that arise from the use of new inventions and endeavor to adjust private rights and harmonize conflicting interests by comprehensive statutes for the public welfare. Whatever may be the precise technical rights of the landowner to the airspace above his land, the possibility of his actual occupation and separate enjoyment of it as a feasible accomplishment has through all periods of private ownership been extremely limited. . . . Legislative sanction makes that lawful which otherwise might be a nuisance."

This is the first time that a court of final jurisdiction has so definitely considered the question of airspace ownership in relation to the exercise of the state police power in asserting a right of navigation through the airspace at a reasonable height. Such a liberal attitude of the courts may be expected in future cases on the question of airspace ownership.

Legislation on Trespass

The passage of legislation defining the rights of passage of airplanes in the navigable airspace brings us to a second step in the growth of air law. So far, we have dealt with the development of the theory of airspace ownership by court decisions and the opinions of experts. Definite legislation would remove the question from speculation, except insofar as it might be contested in the United States as a violation of the fifth or the fourteenth amendments to the Federal Constitution. If

the landowner actually owned the airspace over his property, neither a State legislature nor Congress could take that property away from him, unless such deprivation of property rights was proven to be a reasonable exercise of the Federal or State police power.

In 1920, the English Parliament passed an act known as the British Air Navigation Act. It is primarily a regulatory statute, but contains one clause which is of interest to us in a discussion of airspace ownership.

Section 9, Clause 1, contains the following provision relative to air space:

> No action shall lie in respect of trespass or in respect of nuisance, by reason only of flight of aircraft over any property, at a height above the ground, which having regard to wind, weather and all the circumstances of the case, is reasonable, or in the ordinary incidents of such flight, so long as the provisions of this Act and any order made thereunder and of the Convention are duly complied with.[20]

The English Parliament has decided the question for the English Courts. Trespass by flying at a reasonable height is no longer a legal possibility in England. A test case[21] of the validity of this Section of the British Air Navigation Act was tried soon after its passage and was decided in 1926. The Roedean School, a private institution, sued for an injunction to prevent the Cornwall Aviation Company, Limited, from flying their planes over the school. The Court summarily dismissed the plea for an injunction by calling attention to the ninth section of the British Air Navigation Act.

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[20] The "Convention" referred to in this act is the "Convention" relating to the Regulation of Aerial Navigation, October 13, 1919.

[21] Roedean School v. Cornwall Aviation Co., Ltd., 99 Cent. L. Jour. 311.

Federal and State Legislation on Trespass

In the United States there is now in existence both Federal and State legislation dealing with the question of trespass by airplane. Both Federal and State legislation evade the question of changing the common law maxim *ad coelum et ad infernos;* the Federal law, by not mentioning wherein ownership of the airspace resides, and the State legislation by affirming ownership of the air "in the several owners of the surface beneath."[22]

The Air Commerce Act of 1926[23] defines navigable airspace in Section 10, as follows:

> Navigable Air Space.—As used in this act, the term "navigable air space" means air space above the minimum safe altitudes of flight prescribed by the Secretary of Commerce under section 3, and such navigable air space shall be subject to a public right of freedom of interstate and foreign air navigation in conformity with the requirements of this act.

It will be seen from the wording of this Section that the question of ownership has been avoided. The Federal statute is not as forceful in its wording as the British Air Navigation Act, but it appears to the writer to be just as effective in accomplishing its fundamental purpose, namely, the guarantee of a public right of freedom in the use of the navigable airspace of the United States "above the minimum safe altitudes of flight."

Because of the fact that the Federal statute does not affect intrastate operators, it has been necessary to urge the adoption of state laws for the purpose of establishing the legal status of air navigation in relation to

[22] Uniform State Law for Aeronautics, Section 4.
[23] Pub. No. 254, 69th Congress.

general law. To foster the adoption of such state laws, the Uniform State Law of Aeronautics was drafted for the consideration of the State legislatures. This Uniform State Law was approved by the Conference of Commissioners on Uniform State Laws and the American Bar Association. It has been adopted by twenty States and one territory.[24]

The provisions of this Uniform State Law dealing with airspace are found in Sections three and four:

> Ownership of Space.—The ownership of the space above the lands and the waters of this state is declared to be vested in the several owners of the surface beneath, subject to the right of flight described in Section 4.
>
> Lawfulness of Flight.—Flight in aircraft over the lands and waters of this State is lawful, unless at such a low altitude as to interfere with the then existing use to which the land or water, or the space over the land or water, is put by the owner, or unless so conducted as to be imminently dangerous to persons or property lawfully on the land or water beneath.

In Section three, airspace ownership is definitely affirmed to be vested "in the several owners of the surface beneath." The right of flight is recognized "unless at such a low altitude as to interfere" with the unmolested use of the land by its owner.

George B. Logan, in his book, *Aircraft Law Made Plain,* makes a criticism of the legal effect of these legislative efforts to establish public right of freedom of air navigation. He doubts the legal value of the legislation, and states, "Neither the legislature of any State,

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[24] Arizona, Delaware, Idaho, Indiana, Missouri, Montana, Minnesota, Maryland, Michigan, Nevada, New Jersey, North Carolina, North Dakota, Pennsylvania, South Carolina, South Dakota, Tennessee, Utah, Vermont and Wisconsin.

nor Congress, can declare that horseback riding over private grounds by strangers could be lawful. It is quite as absurd to say that flying through privately owned airspace is lawful. If the airspace is not privately owned, the declaration is unnecessary. If it is privately owned, the declaration is without force. Legislative pronouncement cannot destroy title. The courts alone must declare that by common law and in accordance with the established but expanding, growing and flexible rules of common law, there is no such thing as private ownership of airspace above the height of useful occupancy. When this point is definitely settled by the courts, such legislative expressions as are contained in the Uniform State Law and the Air Commerce Act of 1926 are needless."[25]

The author takes issue with George B. Logan upon his assertion that, "The courts alone must declare that . . . there is no such thing as private ownership of airspace above the height of useful occupancy," as a *sine qua non* of legal use of airspace at a reasonable height by aircraft. Mr. Logan appears to be arguing in a circle. If legislative action has declared that navigable airspace shall be subject to a public right of freedom of passage by aircraft, it would appear that such legislation would supersede or take precedence over any common law development. It has certainly been true in the past experience of the courts as new occasions have created new public uses for airspace, the question of ownership of such airspace has not played an important part.[26] Would Mr. Logan argue that the use of the air in radio transmission or the passage of zoning laws regulating the type of structure or height of building, would necessitate a court decision declaring that there

[25] George B. Logan, *Aircraft Law Made Plain*, p. 20, et seq. Also George B. Logan, "The Nature of Flight," 1 *Air Law Review* 1, p. 94.
[26] Report of American Bar Association, Vol. 52, p. 234.

are certain portions of the air column above the owner's property to which he does not have title?[27] Such a practice has not been generally resorted to to justify special public uses of airspace. The exercise of the police power[28] of the Federal and State Governments has been deemed sufficient.

The problem is stated in a slightly different way in the Cornell Law Quarterly,[29] "In declaring a right of passage in the air, the legislatures would be following the analogy of the right of navigation of waters flowing over private lands. The ownership of the bed of a navigable stream by a private person does not make navigation on the surface of the stream a trespass."

Flying as a Nuisance

The legal aspects of flying as a nuisance must be considered separately from the question of the right of flight at a reasonable altitude. While the majority of writers and jurists have maintained that airspace ownership is at least subject to a public easement of right of flight, they have also agreed that such flight must be so conducted so as not to commit a nuisance.

Flying at low altitude, acrobatics or excessive noise may all constitute an actionable nuisance. The Uniform State Law takes cognizance of this by prohibiting "flying at such low heights as to interfere with the then existing use," or "unless so conducted as to be imminently dangerous to persons and property."[30] Dudley C. Lunt, admir-

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[27] For similar viewpoint see Report of American Bar Association, Vol. 52, p. 234.

[28] Police Power is referred to here as the power of the Federal and State Governments to legislate for the safety, morals, welfare and convenience of the people.

[29] *Cornell Law Quarterly,* Vol. VI, p. 298, et seq. See also note 13 in this Chapter.

[30] Uniform State Law for Aeronautics, Section 4.

ably summarizes this type of legislation in the United States, "Twenty-three acts, with ill-defined penalties, prescribe such flying over populated areas and open air assemblages. Although safety lies in height, only eight of them mention minimum altitudes. Two acts prohibit acrobatic flying over a flying field, the last place a wise pilot would seek."[31]

It becomes quite evident, upon the most casual perusal of Section 4 of the Uniform State Law, that the criticism of Mr. Lunt has real significance. When does flying become so low as to "interfere with the then existing use?" What constitutes interference? When is flying "so conducted as to be imminently dangerous to persons and property?" The terminology used seems to be weasel worded and very vague. It would appear that the drafters of the Uniform State Law for Aeronautics could have saved the courts much needless interpretation by a more careful wording of the Uniform State Law.

Another act which might constitute actionable trespass is the continuous hovering over private property. This point of view is maintained by many writers on aviation law. Mr. J. B. McKenzie believes that any hovering over property by an aircraft so as to interfere with privacy would be a nuisance.[32] Hazeltine, in his book, *Law of the Air,*[33] holds the same point of view. He says, "Quite clearly hovering over the land, even at a considerable height, might well be viewed as a nuisance, even if it were not looked upon as a trespass." S. E. Edmunds draws a similar conclusion in reference to a captive balloon carried by the wind over the land of an

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[31] Article by D. C. Lunt in the *American Mercury,* June, 1929, reviewed in *New York Times,* May 28, 1929, editorial page.

[32] *Canada Law Journal,* Vol. 48, No. 7, p. 210.

[33] Page 82.

adjacent owner. He believes that such a circumstance "may constitute a trespass or at least a nuisance."[34]

Nuisance created by excessive noise of aircraft will be a real problem in the near future unless a successful muffling device is perfected. It is a well settled rule of law that noise constitutes an actionable nuisance for which the courts will award damages. There is nothing that would indicate that the rule of law would apply differently to aircraft.

There has been one case decided in England dealing with the question of noise caused by the operation of aircraft.[35] An injunction suit was brought by residents along the Thames to prevent the testing of aircraft engines over the river in such a noisy manner as to cause a nuisance. The court granted the injunction with a temporary suspension in order to give the defendants an opportunity to minimize or eliminate the noise.

Silent operation of aircraft appears to be much more possible than silent operation of other modes of transportation.[36] Granted that aircraft operation must be noisy, so also has been the operation of other public conveyances such as elevated railroads and street cars. The courts have not enjoined them from noisy operation. Numerous cases may be cited which establish the principle that the individual must suffer inconveniences where

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[34] *St. Louis Law Review,* p. 88. For other opinions see J. M. Spaight, *Aircraft in Peace and the Law,* p. 56. Also, an article by O. M. Biggar in the *Canada Law Journal,* Vol. 48, No. 2. Two similar opinions may be noted in 48 *Am. L. Rev.* 914, and The Grotius Society, Vol. 7, p. 73. For a strong statement of S. E. Edmunds' position read Carl Zollman, *Law of the Air,* p. 55.

[35] Bosworth-Smith v. Gwynnes, Ltd., 122 L. T. 15. Reviewed in *Aircraft Law Made Plain,* G. B. Logan, p. 26. See also, Swetland v. Curtis Airports Corp.; 41 F. (2nd), 929.

[36] For a study of this problem see Technical Memorandum No. 473, National Advisory Committee for Aeronautics, "The Problem of Noise in Civil Aircraft and the Possibilities of Its Elimination," W. S. Tucker.

public necessity is involved.[37] There is a possibility that this rule of law may apply at least to those aircraft operating as common carriers.

In the case of Smith v. New England Aircraft Company, mentioned previously in this chapter, the court declared that flying over property at an altitude of 100 feet or less constituted a trespass and entitled the owner to damage. "Air navigation, important as it is, cannot rightly levy toll upon the legal rights of others for its successful prosecution. No reason has been suggested why airports of sufficient area may not be provided so that take-offs and landings may be made without trespass upon the land of others. If, in the interests of aerial navigation, rights of flight at such low altitude over lands of others are of sufficient public importance, doubtless the power of eminent domain for acquisition of rights of way in airspaces may be authorized. We do not decide whether or to what extent flight by aircraft over private land at a lower altitude than 500 feet may be authorized in the exercise of the police power. As already pointed out, existing statutes and regulations do not go to that extent."[38]

The whole problem of flying as a nuisance is too unsettled from a legal standpoint to make any dogmatic predictions. The logical solution, it would appear, is Federal and State legislation definitely defining an actionable nuisance and providing remedies for violation. Such an immediate definition by legislative action would be more conducive to the establishment of aviation on a firmer basis, than the slower process of defining a nuisance by a series of court cases. Aviation interests

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[37] Southern Rd. Co. v. Fisher, 140 Tenn. 428; B. and P. R. Rd. v. Fifth Baptist Church, 108 U. S. 317.

[38] *United States Daily,* March 12, 1930, p. 1; 1930 U. S. Av. R. 1, 170 N. E. 385.

desire to know their legal status now, not ten years hence.

Liability to Persons and Property on the Ground

Discussion of the extent and the scope of liability of the operator of an aircraft for damages to persons and property on the ground has been a veritable battle ground for lawyers. The controversy is being waged between two schools of legal thought. One group maintains the common law rule applying to other modes of transportation, that liability is attached to the operator of aircraft only on proof of negligence. The other group holds the opinion that aircraft operators are absolutely liable for any damage arising out of such operation with or without proof of negligence, unless the damage was the result of the negligence of the injured persons.

Briefly, reviewing the theory of damage cases, it is necessary for the plaintiff to prove evidence of negligence on the part of the defendant. Failure to prove negligence will result in a non-suit. Hence the "burden of proof" has fallen upon the plaintiff. The application of this theory to aircraft presents certain obvious objections. Proof of negligence would be difficult to establish if an aircraft crashed into your barn, set it on fire and killed the aviator. It might be very true that you have suffered damages and that you were not at fault, but if you wished to recover you would have to prove negligence.

Aviation law is in its swaddling clothes and it may be argued by those exponents of "liability on proof of negligence only" that it has not been so long ago since the automobile was considered a "dangerous machine, and that the operation of the motor vehicle on a public

thoroughfare is necessarily hazardous," only to have this opinion later modified by the courts into an interpretation that "a motor vehicle is not a machine of danger when controlled by an intelligent, prudent driver."[39] These exponents might continue by stating that, "even where articles dangerous in kind have been used the law has held that where proper care has been used no liability attaches,[40] or, "mischief, which could by no reasonable possibility have been foreseen, and which no reasonable person would have anticipated, cannot be taken into account as a basis upon which to predict a wrong."[41] The above would constitute a fairly good brief for the contention that no liability is incurred, where the operator of an aircraft has exercised due diligence and could not foresee the accident.

In at least two cases tried in this country, the legal principle employed was proof of negligence. The first case was decided in 1915 in the Supreme Court of Wisconsin.[42] The State Board of Agriculture had engaged an aviator to give flying exhibitions at a state fair. During one of these exhibitions the airplane suddenly fell and injured several spectators seated in the grandstand, including Irene Morrison, the plaintiff. Miss Morrison was denied damages on the ground that the state board in conducting the fair was engaged in a governmental function and was not liable.

The decision is not important in this discussion. In the course of the trial, several questions were submitted to the jury which have a bearing on our problem. Two of these questions were, "Did Hoxey (the aviator) at the time he attempted the ascent handle his aeroplane in a

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[39] Huddy on Automobiles, p. 28.
[40] Favo v. Remington Arms Company, 67 N. Y. App. Div. 414.
[41] Wabash v. Locks, 112 Ind. 404.
[42] Morrison v. MacLaren, 160 Wis. 621; 152 N. W. 475.

negligent manner? Answer: No. Did any want of ordinary care on the part of the plaintiff proximately contribute to her injury? Answer: No."[43] It would appear, then, that a suit instituted against Hoxey would have failed because the jury did not find him negligent.

In a second case, very similar in facts to Morrison v. MacLaren, the plaintiff was allowed to recover.[44] This case was decided in 1914. The fair association was held liable for injury to a child who was struck by the wing of an airplane in landing, because of the association's failure to provide sufficient safeguards for spectators around the landing place. The basis of the court decision was the proof of negligence. If sufficient proof of negligence had been lacking the plaintiff would have failed to recover.[45] To the layman, the common law rule requiring proof of negligence, appears to work to the injustice of the injured party.

The admission of the injustice of the common law rule has caused several writers to urge the use of the *res ipsa loquitur* or *prima facie* rule of law.[46] The legal effect of this doctrine would be to shift the burden of proof of negligence from the plaintiff to the defendant. Proof of damage or injury by the plaintiff would throw the burden of proof on the aviator of proving no fault or negligence.[47]

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[43] U. S. Aviation Reports, 1928, p. 129.

[44] Platt v. Erie County Agricultural Society, 164 App. Div. 99.

[45] For discussion of authorities upholding the common law rule of evidence see papers by C. W. Cuthell, F. H. LaGuardia, Edmund Ely and J. F. Victory in 8 Cornell Law Quarterly, No. 1, p. 29. The same principle of law applied in a criminal case, People v. Crossan, 1928, U. S. Av. R. 77, involving the death of two bathers caused by the forced landing of an airplane on a bathing beach. Note also, People v. Alexander, 1929, U. S. Av. R. 56.

[46] The *res ipsa loquitur* doctrine is maintained by Thomas H. Marshall, 6 Ill. L. Quarterly, p. 71; W. R. McCracken, 57 Amer. L. Rev. 97; see also legal note in 12 Law Notes 108.

[47] For an excellent defense of this thesis see Air Service Information Circular, Vol. VI, No. 566, pp. 36, 37.

George B. Logan, in writing on this rule of law says, "It was urged that thus the groundsman was relieved of his unsupportable burden of supplying evidence that he did not have. It would then be up to the aviator to show that he had not in fact been negligent; that the fall of the plane was due to an act of God or *force majeure.*" Having shown this he would be relieved of liability. He continues, "The result will enevitably be that the landsman will lose ninety-nine per cent of his law suits against aviators. The landsman is helpless to prevent damage; he will be powerless to recover his loss."[48]

The *res ipsa loquitur* doctrine occupies a middle ground between the doctrines of proof of negligence and absolute liability. It is, perhaps, a more logical and reasonable solution than Logan would have us believe.

One case has been decided in the courts of New York which applies the *res ipsa loquitur* theory.[49] An airplane owned by the State of New York collided with an automobile in which the claimant was a passenger. At the time of the collision, it was proven that the automobile was proceeding in a lawful and prudent manner upon a public highway. The claimant contended that in the absence of any explanation on the part of the State as to how the collision occurred, the doctrine of *res ipsa loquitur* must be applied, for "if the entire circumstances as proven could not have happened without negligence of some kind, negligence is presumed and the burden of explanation is on the defendant." The Court of Claims upheld this doctrine. In its conclusion of law the court stated, "That the said collision occurred without any

[48] G. B. Logan, *op. cit.*, p. 48.

[49] Sollak v. State of New York, State of New York Court of Claims, 1929, U. S. Av. R. 42. Note also the recent decision, Seaman v. Curtis Flying Service, Inc., 231 N. Y. App. Div. 867.

fault or negligence upon the part of the claimant, but solely through the fault, carelessness and negligence of the officer of the Military Department of the State of New York, in charge of operating and flying the said aircraft."

The last doctrine to be considered is that of absolute liability. The doctrine is not a new one to the legal profession. It has been used many times where the object is liable to get out of control and where such loss of control is fraught with great danger to innocent parties or their property.[50] Judge Bramwell expressed a similar opinion in a famous and oft-cited dictum, that if a man kept a tiger and lightning broke its chain so that it got loose, the man who kept the animal would be liable for any injury that might result.[51] In a blasting case, Judge Potter held that, "If the defendant so conducted its work of blasting upon its premises as to cause damage to the plaintiff's property by casting rocks thereon, this amounted to a direct trespass upon premises injured, for which the liability of the defendant was absolute, and for which he is bound to respond in damages without regard to question on negligence.[52]

The doctrine of absolute liability has been held, in many cases,[53] with regard to balloons. The most recent case decided in the United States is Canney v. Rochester Agriculture Association.[54] This case, decided in 1911, attached absolute liability to the fair association which conducted a hot air balloon ascension. It appears that the balloon ascension was accompanied by a parachute

[50] Scribner v. Kelly, 38 Barb. 14; Rylands v. Fletcher, L. R. 3, House of Lords 330; Sullivan v. Dunham, 161 N. Y. 290.

[51] Nichols v. Marsland, 10 Ex. 255, 1875.

[52] Mulchanock v. Whitehall Cement Co., 253 Pa. St. 262.

[53] Guille v. Swan, 19 N. Y. 381; a Belgium case discussed in 26 Green Bag 363 and 44 Chicago Legal News 15.

[54] Canney v. Rochester Agricultural and Mechanical Assn., 76 N. H. 603.

jump. This left the balloon free to land somewhere in the vicinity of the fair ground. Mrs. Canney sued for damages in this case when the balloon fell upon her wagon which was on a public highway.

In applying the balloon cases to airplanes, it is suggested that the same doctrine of absolute liability may be applied. Such eminent authorities as Baldwin, Sperl, Kuhn, Spaight, Zollman and Hazeltine hold this opinion.[55] The doctrine will be most strongly contested by commercial operators of aircraft and insurance companies writing aviation risks. Their counsel will, most probably, maintain that aircraft are not instrumentalities of great danger liable to get out of control. The subsequent development and refinement of aircraft construction may prove their contention to be true.

Legislation on Absolute Liability

Legislation now in effect in Great Britain and the United States provides for absolute liability for injury to persons and property on the ground.

The English Parliament has left no room for doubt in the British Air Navigation Act of 1920.[56]

> Where material damage or loss is caused by an aircraft in flight, taking off, or landing, or by any person in any such aircraft, to any person or property on land or water, damages shall be recoverable from the owner of the aircraft in respect of such damage and loss without proof of negligence or intention, as though the same had been caused by his wilful act, neglect or fault, except where the damage or loss was caused by or contributed to by the negligence of the person by whom the same was suffered.

[55] Chief Justice Baldwin, 9 *Mich. L. Rev.* 20; Hans Sperl, 23 *Green Bag* 398; A. K. Kuhn, 4 *Am. J. of Int. L.* 109; Spaight, *op. cit.*, p. 79; Hazeltine, *op. cit.*, p. 84; Zollman, 53 *Amer. L. Rev.* 879.

[56] British Air Navigation Act, Section 9.

The British Aerial Transport Committee in 1918 recommended this same rule as follows:[57]

> Admittedly persons on land are practically powerless to insure their own safety by precautionary measures against damage caused by the fall of aircraft or of objects carried therein. It is a matter of some doubt whether under existing principles of law a person suffering such damage would be called upon to prove an affirmative case of negligence or intentional trespass. It is possible that the courts might hold aircraft to be within the class of those things which the owner keeps or uses at his peril. We think that it is preferable the principles applicable should be defined by legislation rather than that they should be left for solution by a series of judicial decisions; we think too that as far as damage done by aircraft is concerned, the deprivation of the landowner of what is almost certainly an existing right of property should be compensated by what will be in effect the insurance of himself and his property against such damage.

Both the recommendations of the committee and the British Act indicate the dictum of absolute liability in England.

In the United States, as early as 1911, Connecticut had passed a law which had defined an aviator's liability as absolute,[58] but repealed this statute in 1921.[59] The Uniform State law for Aeronautics affirms the doctrine of absolute liability.[60] Section five provides:

> The owner of every aircraft which is operating over the lands or waters of this State is absolutely liable for injuries to persons or property on the land or water beneath,

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[57] *Cornell Law Quarterly* (6), 271; 146 *Law Times* 106.
[58] Conn. General Statutes, 1918, ch. 176.
[59] Laws of 1921, Ch. 207.
[60] Uniform State Law for Aeronautics, Section 5.

> caused by the ascent, descent, or flight of the aircraft, or the dropping or falling of any object therefrom, whether such owner was negligent or not, unless the injury is caused in whole or in part by the negligence of the person injured, or of the owner or bailee of the property injured. If the aircraft is leased at the time of the injury to person or property, both owner and lessee shall be liable, and they may be sued jointly, or either or both of them may be sued separately.

The uniform state law has been adopted by seventeen states with the above section included.[61] In the 1929 sessions of the state legislatures, Montana, Missouri and Pennsylvania have modified Section five by substituting a liability "with the rules of law applicable to torts on land." A further provision of the Montana statute declares that the liability of the airmen shall be absolute for actual damages caused by a "forced landing" only. These statutes indicate a trend away from the doctrine of absolute liability.

The writer looks with favor toward the use of the doctrine of *res ipsa loquitur*. It seems inevitable that there will be an interesting controversy as to the application of the doctrine to aircraft accidents. In very many cases the causes of such accidents are unknown. In spite of what is considered to be the exercise of utmost care, accidents frequently happen. Proof of negligence

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[61] The Uniform State Law has been adopted with the modification of section five by Missouri, Montana and Pennsylvania. Section five has been retained in the Uniform State Law by Arizona, Delaware, Idaho, Indiana, Maryland, Michigan, Minnesota, Nevada, New Jersey, North Carolina, North Dakota, Tennessee, South Carolina, South Dakota, Utah, Vermont and Wisconsin. The substitutions for section five in Missouri, Montana and Pennsylvania provide that the liability of the aviator for ground damages shall correspond "with the rules of law applicable to torts on land." In Montana L. 1929. ch. 17, section 7, declares that "for damages caused by a forced landing, the owner or lessee of the aircraft shall be liable for actual damage caused by such forced landing."

is difficult to establish in many aviation accidents. It seems reasonable to hold the airman responsible for any damages to the groundman which he cannot affirmatively show was due to a cause beyond his control.

Summary

The present trend of cases on airspace ownership seems to indicate that the aviation industry will experience little difficulty in freely using the airspace as a medium of transportation. We may expect the courts to demand only that such use be of a reasonable nature. It is logical to assume that when such use of the airspace creates a nuisance, the courts will interfere.

On the legal responsibility of the airman to the groundman for damages, the author believes that the usual rules of tort liability with the application of the *res ipsa loquitur* doctrine is to be preferred. Recent State legislation and court decisions seem to repudiate the doctrine of absolute liability.

Only two legal problems have been discussed in this chapter. They are by no means the only ones that will have to be settled by the courts and the rapidly growing fraternity of aviation lawyers. The liability of aviation companies to their employees, the liability of aircraft operators to their pay passengers for personal injuries or loss of baggage,[62] the possibility of voiding a life or accident insurance policy by participating in aviation—these are but a few of the myriad of legal problems that will have to be solved in the very near future.

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[62] For a discussion of the legal aspects of this problem see Harriman, E. A., "Carriage of Passengers by Air," 1 *Journal of Air Law*, 1, p. 33.

XI

CONCLUSIONS AND RECOMMENDATIONS

The preceding chapters lead to certain conclusions as to our future national policy in the regulation and promotion of civil aviation. These conclusions may be classified in three groups, jurisdictional, legislative and administrative.

The Extension of Federal Jurisdiction

The Federal Government has assumed a broad regulative authority over water transportation, the railroads, telegraph and telephone communication and the radio. In all of these businesses, except the radio, local regulation has been permitted when it did not interfere with the national regulative policy. The aviation business provides our most mobile agency of transportation. It is of great importance to its future development that a Federal regulative policy supplant the present conflicting state legislation described in chapter nine. The major problems in the regulation of aviation are not restricted to state boundaries.

The regulation of any business should attempt to promote that business and to protect the public. In chapters four and five it has been shown that the regulative machinery set up by the Department of Commerce to license pilots and aircraft is an efficient and well developed system. Some of the states have adopted the Federal standards of licensing, other states have set up

requirements of their own, while other states have no licensing law. It would seem that such a system of divided control and conflicting state legislation would hinder the development of the aviation business and fail to guarantee to the public competent pilotage and airworthy aircraft. In the interest of safety, one Federal standard of airworthiness and competency of pilotage seems preferable over several conflicting state standards. The licensing of aircraft and pilots is but one of many problems requiring uniform treatment.

Is it possible for us to conceive that one National Government and forty-eight state governments can legislate efficiently for these aspects of commercial aviation? The picture of conflicting state legislation shown in chapter nine would make the answer obvious. The present efforts of the Department of Commerce and the American Bar Association to secure the adoption of a uniform legislative policy among the various states is at best a poor substitute for the uniformity that would be assured by a more inclusive Federal jurisdiction. To further complicate matters these two agencies seeking uniformity do not agree on a common solution.[1] Attempts at uniformity of state legislation in fields other than aviation have not been generally successful. It is true that the Negotiable Instrument Law has been adopted by every state, but even this law has been variously interpreted by the state courts which have reverted to the Law Merchant on many points.

Specifically the author recommends that the Federal jurisdiction over aviation be enlarged so as to permit,

1. The licensing of all aircraft, airmen, airplane and engine mechanics and flying school instructors.

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[1] The proposed state statutes of the Department of Commerce and the American Bar Association are compared in Chapter 9, p. 200.

2. The compulsory rating of all flying schools.

3. The compulsory rating of all airports and landing fields, requiring uniform lighting euipment and uniform field traffic rules.

4. The regulation of rates and service of transport companies when such regulation is deemed advisable.

Legislative Recommendations

1. *The analyses and statistics of aviation accidents reflect the results and the efficacy of the Federal regulations.* The personnel of the Aeronautics Branch realise the need for the more adequate investigation and statistical study of aviation accidents, but have been hindered in their work by the penury of Congress in granting them adequate appropriations. Immediate steps should be taken to impress upon Congress the necessity for a more liberal legislative policy.

To frame constructive regulation it is important to know that fifty-seven per cent of the accidents during the first six months of 1929 were caused by errors of the pilot, that eighteen per cent were attributable to power plant failures, and that in scheduled transport there was one fatality for every 2,817,121 miles flown as compared with miscellaneous flying where there was one fatality for every 359,494 miles flown.[2] Such statistics as these have proved to be of tremendous value, but they are but a beginning. Insurance companies, finance corporations and actuarial societies would like to know the fatality rate per passenger miles in scheduled transport and miscellaneous flying, the relationship of safety to the physical condition and experience of the pilot, and the number of accidents resulting from student instruction in schools

[2] See Chapter 8, p. 189.

rated by the Department of Commerce and in those not rated.

The investigation and analysis of aviation accidents has not received the attention it demands. The present personnel of the Aeronautics Branch handling this work is nothing more than a skeleton organization. Their competency is not questioned. All that remains necessary is the adoption by Congress of a legislative policy that would insure adequate appropriations and personnel for this key activity of the Aeronautics Branch.

2. *The necessity for the uniformity of state airway construction methods.* Because of the public nature of an airway system some governmental agency must continue to provide the aids to navigation found on such well equipped roads of the air. The Federal Government has, up to the present time, paid for this work. On January 1, 1930, the Department of Commerce was maintaining over 12,000 miles of lighted airways. The maintenance cost of this mileage amounts to more than $2,500,000 per year. The States of Pennsylvania, New York, Idaho and Virginia have launched individual state airway construction programs. While none of these programs are of a very comprehensive nature, they are indicative of a trend that may relieve the Federal Government of some of the burden of airway construction costs. It is urged in chapter seven that such state assistance be encouraged. To overcome the possible lack of uniformity in construction methods, it is suggested that a policy be adopted similar to the Federal aid granted to the states in road construction. With such a grant in aid policy a portion of the airway construction cost would be borne by the states, but the Federal Government could secure uniformity by withholding Federal aid until Federal standards had been complied with.

3. *The use of emergency fields as airports.* It is the accepted practice in constructing an airway to provide an emergency field every thirty miles. The entire cost of establishing, equipping and maintaining such intermediate fields is provided for by Federal appropriations except in those instances where local communities have been air-minded enough to rent or buy a landing field and lease it to the Department of Commerce at a nominal figure. This places the field in the category of an aid to navigation and precludes its use as an airport by the local community because of section 5-b of the Air Commerce Act of 1926; "The Secretary of Commerce is authorized . . . to establish, operate and maintain along such airways all necessary air navigation facilities *except airports.*" This situation seems to work an injustice on those communities that co-operate with the Department in establishing intermediate fields. It is therefore recommended that section 5-b be amended so that contributing communities would be permitted the full use of the field as an airport.[3]

4. *Compulsory recordation of liens on aircraft.* The air commerce regulations provide that all licensed aircraft must be registered in the name of the owner. Many airplanes are now sold on the time payment plan. As described in chapter four, finance companies may record liens by submitting to the Department of Commerce an affidavit signed by the purchaser. Commenting on this system, Mr. R. S. Paulett says: "If you contemplated the purchase of a licensed airplane the Department could not state definitely whether or not a lien existed on the plane, but it would be in a position to state whether or not a *properly recorded lien exists on our records.*" Certainly the transfer and sale of aircraft

[3] For further details see Chapter 7, p. 152.

could be put on a sounder basis if the Department had the authority to require the recordation of all liens on aircraft. The enactment of legislation for aircraft similar to the provision of the Marine Act of 1920 is suggested. This act makes invalid, except as between immediate parties, any transfer or sale of ships not recorded with the Department of Commerce. Comparable legislation for aircraft seems highly desirable.

5. *Definition of a nuisance.* The Federal and State legislatures have enacted statutes which assume that the legal right of flight through the navigable airspace does exist. It must be admitted that the nature and extent of this right is far from settled. Three court decisions are cited in chapter ten which indicate that the attitude of our courts will be liberal in sustaining the right of flight of the airman in the navigable airspace. When does this right of flight become a nuisance? Existing legislation is not clear on this point. The Uniform State Law prohibits "flying at such a low altitude as to interfere with the then existing use" or "unless so conducted as to be imminently dangerous to persons and property."[4] The terminology seems very vague. Flying as a nuisance should be more carefully defined by our State legislatures and Congress. This legislation should include restrictions on flying at a low altitude, acrobatics, excessive noise and continuous hovering over private property.[5]

Administrative Recommendations

Regionalization of the activities of the Aeronautics Branch. Believing that the efficiency of the Aeronautics Branch could be materially improved by the decentraliza-

[4] Section 4.

[5] These points are discussed in chapter 10.

tion or regionalization of its activities, several changes in administrative organization are suggested in chapters four and six:

1. The creation of district offices of the Registration Section in each of the nine inspection districts to further facilitate and speed the licensing procedure.

2. The establishment of engine testing stations at several strategic points in the United States in addition to the Washington station.

3. The appointment of a District Flight Surgeon in each of the nine inspection districts to directly supervise the activities of the medical examiners in each respective district. If the Federal Government was authorized by law to license all aircraft and airmen, it would seem that the adoption of such a regionalization plan would be of the greatest importance in providing a speedy and efficient administration.[6]

The sought-for result in this study is a national policy that will adequately protect the public interest and at the same time increase the usefulness of the Department of Commerce to the aeronautical industry. The author believes this result may be accomplished along the lines indicated by the legislative and administrative measures herein suggested.

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[6] Only the conclusions of a major nature have been presented in this chapter. Suggestions of lesser importance are contained in the chapter summaries.

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THE AIR COMMERCE ACT OF 1926

[PUBLIC—NO. 254—69TH CONGRESS]

[S. 41]

An Act To encourage and regulate the use of aircraft in commerce, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That as used in this Act, the term "air commerce" means transportation in whole or in part by aircraft of persons or property for hire, navigation of aircraft in furtherance of a business, or navigation of aircraft from one place to another for operation in the conduct of a business. As used in this Act, the term "interstate or foreign air commerce" means air commerce between any State, Territory, or possession, or the District of Columbia, and any place outside thereof; or between points within the same State, Territory, or possession, or the District of Columbia, but through the airspace over any place outside thereof; or wholly within the airspace over any Territory or possession or the District of Columbia.

SEC. 2. PROMOTION OF AIR COMMERCE.—It shall be the duty of the Secretary of Commerce to foster air commerce in accordance with the provisions of this Act, and for such purpose—

(a) To encourage the establishment of airports, civil airways, and other air navigation facilities.

(b) To make recommendations to the Secretary of Agriculture as to necessary meteorological service.

(c) To study the possibilities for the development of air commerce and the aeronautical industry and trade

in the United States and to collect and disseminate information relative thereto and also as regards the existing state of the art.

(d) To advise with the Bureau of Standards and other agencies in the executive branch of the Government in carrying forward such research and development work as tends to create improved air navigation facilities. The Secretary of Commerce is authorized to transfer funds available for carrying out the purposes of this subdivision to any such agency for carrying forward such research and development work in cooperation with the Department of Commerce.

(e) To investigate, record, and make public the causes of accidents in civil air navigation in the United States.

(f) To exchange with foreign governments through existing governmental channels information pertaining to civil air navigation.

SEC. 3. REGULATORY POWERS.—The Secretary of Commerce shall by regulation—

(a) Provide for the granting of registration to aircraft eligible for registration, if the owner requests such registration. No aircraft shall be eligible for registration (1) unless it is a civil aircraft owned by a citizen of the United States and not registered under the laws of any foreign country, or (2) unless it is a public aircraft of the Federal Government, or of a State, Territory, or possession, or of a political subdivision thereof. All aircraft registered under this subdivision shall be known as aircraft of the United States.

(b) Provide for the rating of aircraft of the United States as to their airworthiness. As a basis for rating, the Secretary of Commerce (1) may require, before the granting of registration for any aircraft first

applying therefor more than eight months after the passage of this Act, full particulars of the design and of the calculations upon which the design is based and of the materials and methods used in the construction; and (2) may in his discretion accept in whole or in part the reports of properly qualified persons employed by the manufacturers or owners of aircraft; and (3) may require the periodic examination of aircraft in service and reports upon such examination by officers or employees of the Department of Commerce or by properly qualified private persons. The Secretary may accept any such examination and report by such qualified persons in lieu of examination by the employees of the Department of Commerce. The qualifications of any person for the purposes of this section shall be demonstrated in a manner specified by and satisfactory to the Secretary. The Secretary may, from time to time, re-rate aircraft as to their airworthiness upon the basis of information obtained under this subdivision.

(c) Provide for the periodic examination and rating of airmen serving in connection with aircraft of the United States as to their qualifications for such service.

(d) Provide for the examination and rating of air navigation facilities available for the use of aircraft of the United States as to their suitability for such use.

(e) Establish air traffic rules for the navigation, protection, and identification of aircraft, including rules as to safe altitudes of flight and rules for the prevention of collisions between vessels and aircraft.

(f) Provide for the issuance and expiration, and for the suspension and revocation, of registration, aircraft, and airman certificates, and such other certificates as the Secretary of Commerce deems necessary in administering the functions vested in him under this Act.

Within 20 days after notice that application for any certificate is denied or that a certificate is suspended or revoked, the applicant or holder may file a written request with the Secretary of Commerce for a public hearing thereon. The Secretary upon receipt of the request shall forthwith (1) arrange for a public hearing to be held within 20 days after such receipt in such place as the Secretary deems most practicable and convenient in view of the place of residence of the applicant or holder and the place where evidence bearing on the cause for the denial, suspension, or revocation is most readily obtainable, and (2) give the applicant or holder at least ten days' notice of the hearing, unless an earlier hearing is consented to by him. Notice under this subdivision may be served personally upon the applicant or holder or sent him by registered mail. The Secretary, or any officer or employee of the Department of Commerce designated by him in writing for the purpose, may hold any such hearing and for the purposes thereof administer oaths, examine witnesses, and issue subpœnas for the attendance and testimony of witnesses, or the production of books, papers, documents, and other evidence, or the taking of depositions before any designated individual competent to administer oaths. Witnesses summoned or whose depositions are taken shall receive the same fees and mileage as witnesses in courts of the United States. All evidence taken at the hearing shall be recorded and forwarded to the Secretary for decision in the matter to be rendered not later than ten days after completion of the hearing. The decision of the Secretary, if in accordance with law, shall be final. The denial, suspension, or revocation shall be invalid unless opportunity for hearing is afforded, notice served or sent,

and decision rendered within the respective times prescribed by this subdivision.

SEC. 4. AIRSPACE RESERVATIONS.—The President is authorized to provide by Executive order for the setting apart and the protection of airspace reservations in the United States for national defense or other governmental purposes and, in addition, in the District of Columbia for public safety purposes. The several States may set apart and provide for the protection of necessary airspace reservations in addition to and not in conflict either with airspace reservations established by the President under this section or with any civil or military airway designated under the provisions of this Act.

SEC. 5. AIDS TO AIR NAVIGATION.—(a) Whenever at any time the Postmaster General and the Secretary of Commerce by joint order so direct, the airways under the jurisdiction and control of the Postmaster General, together with all emergency landing fields and other air navigation facilities (except airports and terminal landing fields) used in connection therewith, shall be transferred to the jurisdiction and control of the Secretary of Commerce, and the established airports and terminal landing fields may be transferred to the jurisdiction and control of the municipalities concerned under arrangements subject to approval by the President. All unexpended balances of appropriations which are available for and which have been allotted for expenditure upon such airways, emergency landing fields, and other air navigation facilities, except airports and terminal landing fields, shall thereupon be available for expenditure under the direction of the Secretary of Commerce, in lieu of the Postmaster General, for the purposes for which such appropriations were made. No part of such unexpended balances of appropriations shall be used for

the purchase or establishment of airports or terminal landing fields.

(b) The Secretary of Commerce is authorized to designate and establish civil airways and, within the limits of available appropriations hereafter made by the Congress, (1) to establish, operate, and maintain along such airways all necessary air navigation facilities except airports; and (2) to chart such airways and arrange for publication of maps of such airways, utilizing the facilities and assistance of existing agencies of the Government so far as practicable. The Secretary of Commerce shall grant no exclusive right for the use of any civil airway, airport, emergency landing field, or other air navigation facility under his jurisdiction.

(c) Air navigation facilities owned or operated by the United States may be made available for public use under such conditions and to such extent as the head of the department or other independent establishment having jurisdiction thereof deems advisable and may by regulation prescribe.

(d) The head of any Government department or other independent establishment having jurisdiction over any airport or emergency landing field owned or operated by the United States may provide for the sale to any aircraft of fuel, oil, equipment, and supplies, and the furnishing to it of mechanical service, temporary shelter, and other assistance under such regulations as the head of the department or establishment may prescribe, but only if such action is by reason of an emergency necessary to the continuance of such aircraft on its course to the nearest airport operated by private enterprise. All such articles shall be sold and such assistance furnished at the fair market value prevailing locally as ascertained by the head of such department or establishment. All

amounts received under this subdivision shall be covered into the Treasury; but that part of such amounts which, in the judgment of the head of the department or establishment, is equivalent to the cost of the fuel, oil, equipment, supplies, services, shelter, or other assistance so sold or furnished shall be credited to the appropriation from which such cost was paid, and the balance, if any, shall be credited to miscellaneous receipts.

(e) Section 3 of the Act entitled "An Act to increase the efficiency and reduce the expense of the Signal Corps of the Army, and to transfer the Webster Service to the Department of Agriculture," approved October 1, 1890, is amended by adding at the end thereof a new paragraph to read as follows:

"Within the limits of the appropriations which may be made for such purpose, it shall be the duty of the Chief of the Weather Bureau, under the direction of the Secretary of Agriculture, (a) to furnish such weather reports, forecasts, warnings, and advices as may be required to promote the safety and efficiency of air navigation in the United States and above the high seas, particularly upon civil airways designated by the Secretary of Commerce under authority of law as routes suitable for air commerce, and (b) for such purposes to observe, measure, and investigate atmospheric phenomena, and establish meteorological offices and stations."

(f) Nothing in this Act shall be construed to prevent the Secretary of War from designating routes in the navigable airspace as military airways and prescribing rules and regulations for the use thereof on routes which do not conform to civil airways established hereunder, or to prevent the Secretary of Commerce from designating any military airway as a civil airway, and when so designated it shall thereupon become a civil airway within the

meaning of this Act, and the Secretary of War is hereby authorized to continue the operation of air navigation facilities for any military airway so designated as a civil airway until such time as the Secretary of Commerce can provide for the operation of such facilities.

SEC. 6. FOREIGN AIRCRAFT.—(a) The Congress hereby declares that the Government of the United States has, to the exclusion of all foreign nations, complete sovereignty of the airspace over the lands and waters of the United States, including the Canal Zone. Aircraft a part of the armed forces of any foreign nation shall not be navigated in the United States, including the Canal Zone, except in accordance with an authorization granted by the Secretary of State.

(b) Foreign aircraft not a part of the armed forces of the foreign nation shall be navigated in the United States only if authorized as hereinafter in this section provided; and if so authorized, such aircraft and airmen serving in connection therewith, shall be subject to the requirements of section 3, unless exempt under subdivision (c) of this section.

(c) If a foreign nation grants a similar privilege in respect of aircraft of the United States, and/or airmen serving in connection therewith, the Secretary of Commerce may authorize aircraft registered under the law of the foreign nation and not a part of the armed forces thereof to be navigated in the United States, and may by regulation exempt such aircraft, and or airmen serving in connection therewith, from the requirements of section 3, other than the air traffic rules; but no foreign aircraft shall engage in interstate or intrastate air commerce.

SEC. 7. APPLICATION OF EXISTING LAWS RELATING TO FOREIGN COMMERCE.—(a) The navigation and ship-

ping laws of the United States, including any definition of "vessel" or "vehicle" found therein and including the rules for the prevention of collisions, shall not be construed to apply to seaplanes or other aircraft or to the navigation of vessels in relation to seaplanes or other aircraft.

(b) The Secretary of the Treasury is authorized to (1) designate places in the United States as ports of entry for civil aircraft arriving in the United States from any place outside thereof and for merchandise carried on such aircraft, (2) detail to ports of entry for civil aircraft such officers and employees of the customs service as he may deem necessary, and to confer or impose upon any officer or employee of the United States stationed at any such port of entry (with the consent of the head of the Government department or other independent establishment under whose jurisdiction the officer or employee is serving) any of the powers, privileges, or duties conferred or imposed upon officers or employees of the customs service, and (3) by regulation to provide for the application to civil air navigation of the laws and regulations relating to the administration of the customs and public health laws to such extent and upon such conditions as he deems necessary.

(c) The Secretary of Commerce is authorized by regulation to provide for the application to civil aircraft of the laws and regulations relating to the entry and clearance of vessels to such extent and upon such conditions as he deems necessary.

(d) The Secretary of Labor is authorized to (1) designate any of the ports of entry for civil aircraft as ports of entry for aliens arriving by aircraft, (2) detail to such ports of entry such officers and employees of the immigration service as he may deem necessary, and to

confer or impose upon any employee of the United States stationed at such port of entry (with the consent of the head of the Government department or other independent establishment under whose jurisdiction the officer or employee is serving) any of the powers, privileges, or duties conferred or imposed upon officers or employees of the immigration service, and (3) by regulation to provide for the application to civil air navigation of the laws and regulations relating to the administration of the immigration laws to such extent and upon such conditions as he deems necessary.

SEC. 8. ADDITIONAL ASSISTANT SECRETARY OF COMMERCE.—To aid the Secretary of Commerce in fostering air commerce and to perform such functions vested in the Secretary under this Act as the Secretary may designate there shall be an additional Assistant Secretary of Commerce, who shall be appointed by the President, by and with the advice and consent of the Senate, and whose compensation shall be fixed in accordance with the Classification Act of 1923. Except as otherwise specifically provided, the Secretary of Commerce shall administer the provisions of this Act and for such purpose is authorized (1) to make such regulations as are necessary to execute the functions vested in him by this Act; (2) to make such expenditures (including expenditures for personal services and rent at the seat of government and elsewhere and for law books, books of reference, and periodicals) as may be necessary for such administration and as may be provided for by the Congress from time to time; (3) to publish from time to time a bulletin setting forth such matters relating to the functions vested in him by this Act as he deems advisable, including air navigation treaties, laws, and regulations and decisions thereunder; and (4) to operate, and for

this purpose to acquire within the limits of the available appropriations hereafter made by the Congress, such aircraft and air navigation facilities, except airports, as are necessary for executing the functions vested in the Secretary of Commerce by this Act.

SEC. 9. DEFINITIONS.—As used in this Act—

(a) The term "citizen of the United States" means (1) an individual who is a citizen of the United States or its possessions, or (2) a partnership of which each member is an individual who is a citizen of the United States or its possessions, or (3) a corporation or association created or organized in the United States or under the law of the United States or of any State, Territory, or possession thereof, of which the president and two-thirds or more of the board of directors or other managing officers thereof, as the case may be, are individuals who are citizens of the United States or its possessions and in which at least 51 per centum of the voting interest is controlled by persons who are citizens of the United States or its possessions.

(b) The term "United States," when used in a geographical sense, means the territory comprising the several States, Territories, possessions, and the District of Columbia (including the territorial waters thereof), and the overlying airspace; but shall not include the Canal Zone.

(c) The term "aircraft" means any contrivance now known or hereafter invented, used, or designed for navigation of or flight in the air, except a parachute or other contrivance designed for such navigation but used primarily as safety equipment.

(d) The term "public aircraft" means an aircraft used exclusively in the governmental service.

(e) The term "civil aircraft" means any aircraft other than a public aircraft.

(f) The term "aircraft of the United States" means any aircraft registered under this Act.

(g) The term "airport" means any locality, either of water or land, which is adapted for the landing and taking off of aircraft and which provides facilities for shelter, supply, and repair of aircraft; or a place used regularly for receiving or discharging passengers or cargo by air.

(h) The term "emergency landing field" means any locality, either of water or land, which is adapted for the landing and taking off of aircraft, is located along an airway, and is intermediate to airports connected by the airway, but which is not equipped with facilities for shelter, supply, and repair of aircraft and is not used regularly for the receipt or discharge of passengers or cargo by air.

(i) The term "air navigation facility" includes any airport, emergency landing field, light or other signal structure, radio directional finding facility, radio or other electrical communication facility, and any other structure or facility, used as an aid to air navigation.

(j) The term "civil airway" means a route in the navigable airspace designated by the Secretary of Commerce as a route suitable for interstate or foreign air commerce.

(k) The term "airman" means any individual (including the person in command and any pilot, mechanic, or member of the crew) who engages in the navigation of aircraft while under way, and any individual who is in charge of the inspection, overhauling, or repairing of aircraft.

SEC. 10. NAVIGABLE AIRSPACE.—As used in this

Act, the term "navigable airspace" means airspace above the minimum safe altitudes of flight prescribed by the Secretary of Commerce under section 3, and such navigable airspace shall be subject to a public right of freedom of interstate and foreign air navigation in conformity with the requirements of this Act.

SEC. 11. PENALTIES.—(a) It shall be unlawful, except to the extent authorized or exempt under section 6—

(1) To navigate any aircraft within any airspace reservation otherwise than in conformity with the Executive orders regulating such reservation.

(2) To navigate any aircraft (other than a foreign aircraft) in interstate or foreign air commerce unless such aircraft is registered as an aircraft of the United States; or to navigate any foreign aircraft in the United States.

(3) To navigate any aircraft registered as an aircraft of the United States, or any foreign aircraft, without an aircraft certificate or in violation of the terms of any such certificate.

(4) To serve as an airman in connection with any aircraft registered as an aircraft of the United States, or any foreign aircraft, without an airman certificate or in violation of the terms of any such certificate.

(5) To navigate any aircraft otherwise than in conformity with the air traffic rules.

(b) Any person who (1) violates any provision of subdivision (a) of this section or any entry or clearance regulation made under section 7, or (2) any customs or public health regulation made under such section, or (3) any immigration regulation made under such section, shall be subject to a civil penalty of $500 which may be remitted or mitigated by the Secretary of Commerce, the

Secretary of the Treasury, or the Secretary of Labor, respectively, in accordance with such proceedings as the Secretary shall by regulation prescribe. In case the violation is by the owner or person in command of the aircraft, the penalty shall be a lien against the aircraft. Any civil penalty imposed under this section may be collected by proceedings in personam against the person subject to the penalty and/or in case the penalty is a lien, by proceedings in rem against the aircraft. Such proceedings shall conform as nearly as may be to civil suits in admiralty; except that either party may demand trial by jury of any issue of fact, if the value in controversy exceeds $20, and facts so tried shall not be reexamined other than in accordance with the rules of the common law. The fact that in a libel in rem the seizure is made at a place not upon the high seas or navigable waters of the United States, shall not be held in any way to limit the requirement of the conformity of the proceedings to civil suits in rem in admiralty. The Supreme Court of the United States, and under its direction other courts of the United States, are authorized to prescribe rules regulating such proceedings in any particular not provided by law. The determination under this section as to the remission or mitigation of a civil penalty imposed under this section shall be final. In case libel proceedings are pending at any time during the pendency of remission or mitigation proceedings, the Secretary shall give notice thereof to the United States attorney prosecuting the libel proceedings.

(c) Any aircraft subject to a lien for any civil penalty imposed under this section may be summarily seized by and placed in the custody of such persons as the appropriate Secretary may by regulation prescribe and a report of the case thereupon transmitted to the United

States attorney for the judicial district in which the seizure is made. The United States attorney shall promptly institute proceedings for the enforcement of the lien or notify the Secretary of his failure so to act. The aircraft shall be released from such custody upon (1) payment of the penalty or so much thereof as is not remitted or mitigated, (2) seizure in pursuance of process of any court in proceedings in rem for enforcement of the lien, or notification by the United States attorney of failure to institute such proceedings, or (3) deposit of a bond in such amount and with such sureties as the Secretary may prescribe, conditioned upon the payment of the penalty or so much thereof as is not remitted or mitigated.

(d) Any person who fraudulently forges, counterfeits, alters, or falsely makes any certificate authorized to be issued under this Act, or knowingly uses or attempts to use any such fraudulent certificate shall be guilty of an offense punishable by a fine not exceeding $1,000 or by imprisonment not exceeding three years, or by both such fine and imprisonment.

(e) Any person (1) who, with intent to interfere with air navigation in the navigable airspace or waters of the United States, exhibits within the United States any false light or signal at such place or in such manner that it is likely to be mistaken for a true light or signal required by regulation under this Act, or for a true light or signal in connection with an airport or other air navigation facility, or (2) who, after due warning from the Secretary of Commerce continues to maintain any false light or signal, or (3) who knowingly removes, extinguishes, or interferes with the operation of any such true light or signal, or (4) who without lawful authority knowingly exhibits any such true light or signal, shall be guilty of an offense punishable by a fine not exceeding

$5,000 or by imprisonment not exceeding five years, or by both such fine and imprisonment.

(f) All penalties paid under this Act, shall be covered into the Treasury as miscellaneous receipts.

SEC. 12. SEPARABILITY.—If any provision of this Act is declared unconstitutional or the application thereof to any person or circumstance is held invalid, the validity of the remainder of the Act and the application of such provision to other persons and circumstances shall not be affected thereby.

SEC. 13. TIME OF TAKING EFFECT.—This Act shall take effect upon its passage; except that no penalty shall be enforced for any violation thereof occurring within 90 days thereafter.

SEC. 14. SHORT TITLE.—This Act may be cited as the "Air Commerce Act of 1926."

Aproved, May 20, 1926.

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